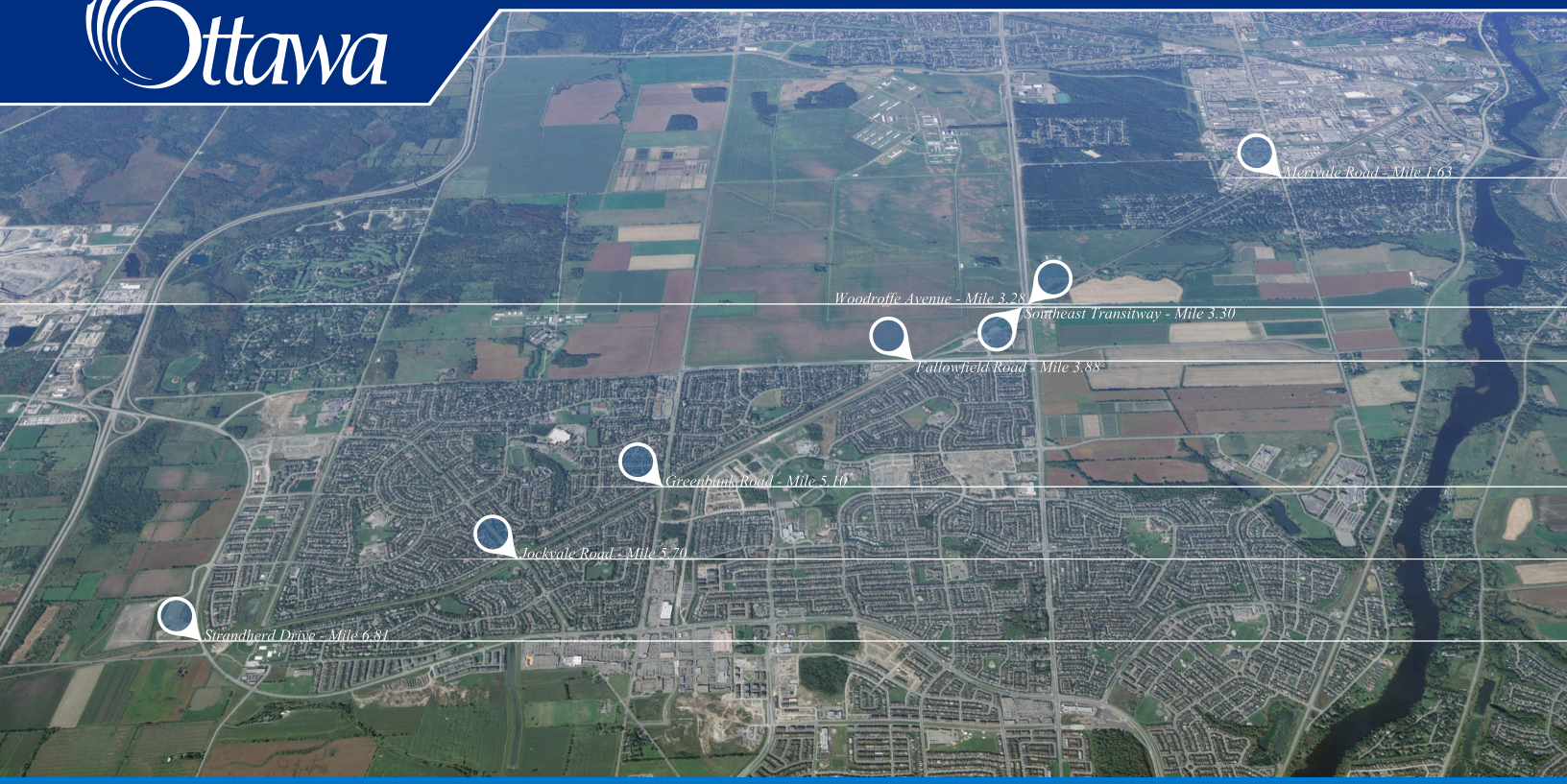
May 2017



Barrhaven and Merivale Road Rail Crossing Grade Separation Study

PARSONS

BARRHAVEN AND MERIVALE ROAD RAIL CROSSING
GRADE SEPARATION STUDY

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Executive Summary

Within the City of Ottawa in the suburb of Barrhaven and nearby there are several at-grade rail crossings that are being assessed for grade separation. The City of Ottawa has partnered with VIA Rail Canada to conduct a high level study to review the need for grade separation along the Smiths Falls Subdivision track at the Merivale Road (Mile 1.63), Woodroffe Avenue (Mile 3.28), Southwest Transitway (Mile 3.30), Fallowfield Road (Mile 3.88), and Jockvale Road (Mile 5.7) crossings. The City of Ottawa has contracted Parsons to perform this planning-level grade separation study for the five crossings noted. At the time of this report a grade separation for Greenbank Road (Mile 5.1) was recently constructed and the detailed design for a grade separation for Strandherd Drive (Mile 6.81) is advancing with detailed design for the overpass solution. The Greenbank Road and Strandherd Drive grade separations will not be part of this study although some of the costing elements were based on actual costs experienced at Greenbank Road project. This study included a review of all previous study work related to these crossings; an analysis of current and projected traffic data; a review of existing geotechnical recommendations; a review of alternate road and track alignments including permanent and temporary detours; a review of underpass or overpass structural arrangements and implications; a high level review of potential environmental and social economic impacts; Class "D" cost estimates for any preferred works; and any recommendations that could enhance safety at the crossings in the interim.

Grade-Separations Summary Table – Planning Status and Study Emphasis

#	Route Crossing	Mile	Grade Separation Situation	Grade Separation Planning Status	Grade Separation Design Status	Study Emphasis
1	Merivale Road	1.63	At-grade Crossing Requiring Solution	Environmental Assessment (EA) Completed 2004 *Class EA Amendment Required*	Concept Plan/Functional Design	Review Existing EA Design Concepts
2	Woodroffe Avenue	3.28	At-grade Crossing Requiring Solution	Federal EA Completed 2004 *Municipal Class EA Required*	Concept Plan/Functional Design	Review Existing EA Design Concepts
3	Southwest Transitway	3.30	At-grade Crossing Requiring Solution	Federal EA Completed 2004 *Municipal Class EA Required*	Concept Plan/Functional Design	Review Existing EA Design Concepts

4	Fallowfield Road	3.88	At-grade Crossing Requiring Solution	No EA *Municipal Class EA Required*	Draft Preliminary Design completed (Parsons)	Review Existing EA & Partially Completed Detailed Design
-	Greenbank (Not part of this Study)	5.1	Grade Separated Crossing Recently Constructed	EA Completed	Construction Substantially Complete	Refer to lessons learned, tender pricing
5	Jockvale	5.73	At-grade Crossing Requiring Solution	No EA *Municipal Class EA Required*	No designs	Prepare New Design Concept
-	Strandherd (Not Part of this Study)	6.8	At-grade Crossing Requiring Solution	EA Completed	Advancing with detailed design for overpass solution	Refer to existing design and costing, lessons learned

The Grade Crossing Regulations prepared by Transport Canada provide little guidance as to when grade separation should be considered. Common practice for determining grade separation requirements in Canada is to use a Crossing Exposure Index (CEI) calculation, also known as cross-product value, and a review of risks at the crossing. The United States Department of Transportation Federal Highway Administration "Railroad-Highway Grade Crossing Handbook" was also reviewed as it provides more prescriptive benchmarks to consider grade separation. Historically a cross-product of 200,000 has been accepted as the benchmark used by Transport Canada in determining when grade separation should be considered. The cross-product is determined by multiplying the Average Annual Daily Traffic (AADT) by the average daily number of trains at the at-grade crossing. Below is a summary of the CEI values at each crossing location with the preferred grade separation solutions and associated estimate cost.

Grade-Separations Summary Table: CEI, Preferred Solution, and Cost							
#	**Route Crossing**	**Mile**	**Traffic Volume *AADT** **2016** **2021** **2031**	**Train Volume** **2016** **2021** **2031** **HFR**	**Crossing Exposure Rate** **2016** **2021** **2031**	**Preferred Grade Separation Solution**	**Class "D" Cost Estimate (including risk contingency)**
1	Merivale Road	1.63	16,458 18,201 22,186	26 33 49	427,908 600,633 1,087,114	Underpass Road under Rail	$75M

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2	Woodroffe Avenue	3.28	30,619 33,806 41,209	26 33 49	796,094 1,115,598 2,019,241	Overpass Road over Rail	$145M for Woodroffe & Transitway
3	Southwest Transitway	3.30	1,136 x 32** 1,389 x 32** 2,076 x 32**	26 33 49	945,152** 1,466,784** 3,255,168**	Overpass Road over Rail	$145M for Woodroffe & Transitway
4	Fallowfield Road	3.88	29,468 32,535 39,660	19 21 37	559,892 683,235 1,467,420	Overpass Road over Rail	$130M
5	Jockvale Road	5.73	11,452 12,643 15,412	19 21 37	217,588 265,503 570,244	Underpass Road under Rail	$80M

HFR = High Frequency Rail which is currently being considered by VIA although at this time it has not been approved.
* AADT includes suggested growth rates.
** For the Transitway an Occupant Crossing Exposure Index was used based on an average of 32 riders per bus.

This study found that the Merivale Road, Woodroffe Avenue, Southwest Transitway, Fallowfield Road, and Jockvale Road crossings are currently above the 200,000 threshold and by 2031 will be well beyond the threshold. It is the recommendation of this report that grade separated facilities be implemented for all five crossing locations being reviewed.

Site specific interim measures have also been noted in this study that include geotechnical investigations, new Municipal Class environmental assessments or amendments to existing EA's, federal level environmental affects analysis at NCC or other federal land locations, and strict site plan control to govern adjacent development.

Résumé

À Ottawa, dans la banlieue de Barrhaven et les environs, on envisage la possibilité d'aménager en sauts-de-mouton plusieurs passages à niveau. La Ville d'Ottawa a fait équipe avec VIA Rail Canada pour mener une étude sommaire visant à déterminer si cette solution serait utile sur la ligne de chemin de fer du lotissement de Smiths Falls, aux passages à niveau du chemin Merivale (point milliaire 1,63), de l'avenue Woodroffe (point milliaire 3,28), du Transitway Sud-Ouest (point milliaire 3,30), du chemin Fallowfield (point milliaire 3,88) et du chemin Jockvale (point milliaire 5,7). La Ville a engagé la société Parsons pour réaliser cette étude préliminaire. Au moment de rédiger le présent rapport, un saut-de-mouton vient d'être aménagé sur le chemin Greenbank (point milliaire 5,1) et un autre a fait l'objet d'une conception détaillée, sur la promenade Strandherd (point milliaire 6,81). Ceux-ci ne feront pas partie de l'étude, bien que certains éléments de coûts aient été calculés en fonction des coûts réels engagés pour le projet du chemin Greenbank. L'étude prend en compte plusieurs éléments, dont les suivants : les travaux déjà réalisés en lien avec les passages à niveau; les données réelles et projetées sur la circulation; les recommandations géotechniques en vigueur; les modifications possibles au tracé de la voie publique et du chemin de fer, y compris les détours permanents et temporaires; les dispositions et répercussions structurelles d'un passage inférieur ou supérieur; les retombées socio-économiques et environnementales possibles; une estimation des coûts de catégorie D pour les travaux retenus; et toute recommandation pouvant améliorer la sécurité des passages à niveau d'ici la réalisation des travaux.

Tableau sommaire : étape de planification et objet de l'étude

Nº	**Passage à niveau**	**Point milliaire**	**État actuel**	**Étape de planification**	**Étape de conception**	**Objet de l'étude**
1	Chemin Merivale	1,63	Passage à niveau – Solution requise	Évaluation environnementale (EE) menée en 2004 *EE de portée générale – Modification requise*	Plan conceptuel / conception fonctionnelle	Examiner les concepts des EE en vigueur
2	Avenue Woodroffe	3,28	Passage à niveau – Solution requise	EE fédérale menée en 2004 *EE municipale de portée générale requise*	Plan conceptuel / conception fonctionnelle	Examiner les concepts des EE en vigueur
3	Transitway Sud-Ouest	3,30	Passage à niveau – Solution requise	EE fédérale menée en 2004 *EE municipale de portée générale requise*	Plan conceptuel / conception fonctionnelle	Examiner les concepts des EE en vigueur
4	Chemin Fallowfield	3,88	Passage à niveau – Solution requise	Aucune EE *EE municipale de portée générale requise*	Conception préliminaire réalisée (Parsons)	Examiner les EE en vigueur et les conceptions détaillées en cours d'élaboration

-	Chemin Greenbank (exclu de l'étude)	5,1	Saut-de-mouton Construction récente	EE réalisée	Construction réalisée en grande partie	Tenir compte des leçons apprises et des prix pour les appels d'offres
5	Chemin Jockvale	5,73	Passage à niveau – Solution requise	Aucune EE *EE municipale de portée générale requise*	Aucune conception	Élaborer un nouveau plan conceptuel
-	Promenade Strandherd (exclu de l'étude)	6,8	Passage à niveau – Solution requise	EE réalisée	Conception détaillée entamée	Tenir compte de la conception, des coûts et des leçons apprises

Le *Règlement sur les passages à niveau* établi par Transports Canada offre peu d'indications sur les situations où un saut-de-mouton devrait être envisagé. Pour déterminer si cette option s'impose, la pratique courante au Canada consiste à calculer l'indice de risque du passage à niveau, c'est-à-dire le produit vectoriel, et d'analyser les risques présents. Les auteurs de l'étude se sont également inspirés de l'ouvrage *Railroad-Highway Grade Crossing Handbook* produit par la Federal Highway Administration du département des Transports des États-Unis, car ce manuel contient des critères plus normatifs pour déterminer le bien-fondé d'un saut-de-mouton. Ordinairement, Transports Canada utilise un produit vectoriel de 200 000 comme point de référence pour déterminer s'il faut envisager ce type de construction. Pour calculer cette valeur, on multiplie le débit journalier moyen d'une année (DJMA) sur la voie publique par le nombre journalier moyen de trains traversant le passage à niveau. Le tableau suivant présente l'indice de risque de chacun des passages à niveau, ainsi que la solution retenue et les coûts estimés.

Tableau sommaire : Indice de risque, solution retenue et coûts

Nº	**Passage à niveau**	**Point milliaire**	**DJMA* en 2016, 2021 et 2031**	**Trains en 2016, 2021 et 2031 (TFE)**	**Indice de risque en 2016, 2021 et 2031**	**Solution retenue**	**Estimation des coûts de catégorie D (y compris les fonds de prévoyance)**
1	Chemin Merivale	1,63	16 458 18 201 22 186	26 33 49	427 908 600 633 1 087 114	Passage inférieur Sous le chemin de fer	75 millions de dollars
2	Avenue Woodroffe	3,28	30 619 33 806 41 209	26 33 49	796 094 1 115 598 2 019 241	Passage supérieur Au-dessus du chemin de fer	145 millions de dollars pour l'avenue Woodroffe et le Transitway

3	Transitway Sud-Ouest	3,30	1 136 × 32** 1 389 × 32** 2 076 × 32**	26 33 49	945 152** 1 466 784** 3 255 168**	Passage supérieur Au-dessus du chemin de fer	145 millions de dollars pour l'avenue Woodroffe et le Transitway
4	Chemin Fallowfield	3,88	29 468 32 535 39 660	19 21 37	559 892 683 235 1 467 420	Passage supérieur Au-dessus du chemin de fer	130 millions de dollars
5	Chemin Jockvale	5,73	11 452 12 643 15 412	19 21 37	217 588 265 503 570 244	Passage inférieur Sous le chemin de fer	80 millions de dollars

TFE = Train à fréquence élevée envisagé par VIA Rail, mais qui n'a pas encore été approuvé.
* Cette valeur comprend les taux de croissance suggérés.
** Pour le Transitway, l'indice de risque des usagers a été calculé sur une moyenne de 32 passagers par autobus.

L'étude a révélé que les passages à niveau au chemin Merivale, à l'avenue Woodroffe, au Transitway Sud-Ouest, au chemin Fallowfield et au chemin Jockvale dépassent actuellement la valeur limite de 200 000 et continueront d'augmenter d'ici 2031. Le présent rapport recommande donc d'aménager des sauts-de-mouton aux cinq emplacements à l'étude.

Enfin, l'étude fait état de plusieurs mesures provisoires propres à chaque site, par exemple la réalisation d'études géotechniques, la réalisation de nouvelles évaluations environnementales municipales de portée générale, la modification d'évaluations environnementales en vigueur, la réalisation d'évaluations environnementales fédérales sur les terrains de la CCN ou d'autres terrains fédéraux, et une réglementation stricte du plan d'implantation pour encadrer les aménagements dans le secteur.

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Sign-off Sheet

This document entitled City of Ottawa Grade Separation Study was prepared by Parsons for the account of the City of Ottawa (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Parsons' professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Parsons and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Parsons did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party.

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1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The City of Ottawa and VIA Rail Canada have been reviewing at-grade crossings along the Smiths Falls Subdivision within City limits. As the City of Ottawa has grown the number of vehicles crossing the various level crossings on this railway subdivision has increased which has resulted in a need to consider whether grade separation would be warranted. In Canada, there is no published standard available for determining when a grade separation is warranted however the Crossing Exposure Index (CEI) is the accepted practice which involves multiplying the number of trains crossing in a day by the Average Annual Daily Traffic (AADT). This method is used more prescriptively in the United States as noted in the United States Department of Transportation Federal Highway Administration "Railroad-Highway Grade Crossing Handbook", which provides benchmarks for when to consider grade separation. Historically, in Canada, a cross-product of 200,000 has been accepted as the benchmark used by Transport Canada in determining when grade separation should be considered along with a detailed safety review and risk assessment.

This report provides a review of the existing conditions at five at-grade crossings along the Smiths Falls Subdivision which consist of the following locations:

1. Merivale Road (Mile 1.63),
2. Woodroffe Avenue (Mile 3.28),
3. Southwest Transitway (Mile 3.30),
4. Fallowfield Road (Mile 3.88), and
5. Jockvale Road (Mile 5.70)

The CEI was calculated for each of the above locations based on the latest traffic and train count information. Also, a broad review of site specific features and factors influencing risk was assessed. A recommendation was made about how to provide grade separation for each location as it was determined that all five locations will need to be grade separated.

Within this report there are many reduced size images which have been included for reference. Larger versions of the images are included in *Appendix G* to provide additional clarity.

1.2 BACKGROUND

As the City of Ottawa has grown the Annual Average Daily Traffic (AADT) experienced across the at grade rail crossings in the Smiths Falls Subdivision has increased along with the number of trains along this corridor resulting in a need to review these crossings for potential grade separation. Detailed safety assessments conducted jointly by VIA and the City on those crossings, have identified a need for grade separation due to the increase in the Crossing Exposure Index. Additional study has been undertaken by the City of Ottawa in response to the collision between a City of Ottawa OC Transpo bus and a VIA Rail Canada Inc. train that occurred on September 18, 2013 in Barrhaven. On that day at about 08:32 E.S.T. the west bound VIA Rail passenger train No. 51 departed from the VIA Ottawa Station on time and proceeded on route to Toronto. At 08:47, OC Transpo double-decker bus No. 8017 departed from the Fallowfield Station on the OC Transpo West Transitway. At 08:48, while proceeding at about 43 mph, the train entered the OC Transpo Transitway at-grade crossing, located at Mile 3.30 of VIA's Smiths Falls Subdivision. At the time, the crossing lights, bells and gates were activated. The northbound bus had slowed to a speed of about 5 mph with the brakes applied when it struck the side of the train. As a result of the collision, the

front of the bus was torn off. The train, comprising one (1) locomotive and four (4) passenger cars, derailed but remained upright. Among the bus occupants, there were 6 fatalities and 9 serious injuries, and about 25 minor injuries were reported. No VIA crew members or VIA passengers were injured.

The Smiths Falls Subdivision consists of single main track that extends from near the Rideau River rail bridge (Mile 0.0) at the junction with the Beachburg Subdivision to Smiths Falls, Ontario (Mile 34.40). From Monday to Friday, up to 21 passenger trains and 2 freight trains operate over the crossing each day. The authorized train speed in the vicinity of the crossing is up to 60 mph (97 km/h). However, all VIA trains arriving at the station are slowing to stop and trains departing VIA's Fallowfield Station are reaching 10 to 15 mph at Fallowfield Road and at the Southwest Transitway/Woodroffe Road. In the past the zone speed was 80 mph and there was a plan to increase the corridor speed to 100 mph with Express trains (No stop at Fallowfield Station) but this plan was put on hold. Regardless of the zone speed in this area, actual train speeds have not gone above 70mph due to the train stopping at Fallowfield Station.

On December 2, 2015 the Transportation Safety Board (TSB) released its report on the investigation into the September 2013 accident. The report contains five recommendations, four of which are directed to Transport Canada and one to the City of Ottawa.

TSB Recommendation R15-05 states "The Board recommends that the City of Ottawa reconsider the need for grade separation at the Woodroffe Avenue, Transitway and Fallowfield Road at-grade (level) crossings." The City of Ottawa committed to provide a response to the TSB's recommendation and Council was advised by memorandum that the course of action would be brought before a joint meeting of the Transportation Committee and Transit Commission.

The City agreed to undertake a technical study to determine the feasibility of grade separation at these three level crossings. This study will be in partnership with VIA Rail Canada in recognition of VIA's shared interest in public safety and service reliability at all rail crossings.

In addition, the City will study the Merivale Road and Jockvale Road level crossings in order to have a complete understanding of all remaining level crossings in this part of Ottawa. It should be noted that the level crossings at Greenbank Road, where grade separation construction is currently underway, and Strandherd Road, where grade separation is planned, will not be subject to the feasibility study.

The study will include a review of all previous study work related to these crossings; an analysis of current and projected traffic data; geotechnical review where required; recommendations on whether these crossings could be improved by either an underpass or an overpass; financial estimates for any preferred works; and any recommendations that could enhance safety at the crossings in the interim.

The City of Ottawa has contracted with Parsons to perform a planning-level grade separation study for the five existing at-grade crossings at Merivale Road, Woodroffe Avenue, Southwest Transitway, Fallowfield Road and Jockvale Road. This study will result in a technical memorandum that will provide a high-level overview comparison of the impacts, the benefits and the planning level costs that will assist the City to decide which crossings should be considered for a detailed analysis of a potential conversion from an at-grade rail crossing to a grade separated crossing.

1.3 STUDY AREA

The Study area is the South Urban Community extending from Merivale Road to Jockvale Road in the City of Ottawa on the VIA Rail Smiths Falls Subdivision. VIA Rail has a single track on the Smiths Falls Subdivision which runs nominally in the east west direction and contains seven at-grade crossings. This study will examine the need for grade separation at Merivale Road (Mile 1.63), Woodroffe Avenue (Mile 3.28), Southwest Transitway (Mile 3.30), Fallowfield Road (Mile 3.88) and Jockvale Road (Mile 5.73). The location of each crossing is illustrated in **Figure 1.**

Figure 1: Study Area

1.4 BACKGROUND STUDIES AND DOCUMENTATION

A number of background reports and studies have been compiled with recommendations pertaining to safety and the need for grade-separation. The following table identifies the reports and studies and provides a summary of their findings and recommendations:

Table 1: Summary of Recommendations Related to Grade Separation

Report Title / Previous Studies	Summary of Findings and Recommendations
Transportation Safety Board of Canada (TSB) Railway Investigation Report R13T0192 – Crossing Collision VIA Rail Inc. Passenger Train No. 51 OC Transpo Double-Decker Bus No. 8017, Mile 3.30, Smiths Falls Subdivision, Ottawa, Ontario 18 September 2013	On December 2, 2015 the TSB released its report on the investigations and issued the following five recommendations: *Distracted driving guidelines (R15-01):* Recommendation R15-01 calls for Transport Canada (TC), in consultation with the provinces, to develop comprehensive guidelines for the installation and use of in-vehicle video monitor displays to reduce the risk of driver distraction. *Bus crashworthiness (R15-02):* Recommendation calls for TC to develop and implement crashworthiness standards for commercial passenger buses to reduce the risk of injury. *Vehicle event data recorders (R15-03):* Recommendation R15-03 asks TC to require commercial passenger buses be equipped with dedicated, crashworthy, event data recorders. *Grade separation guidelines (R15-04):* Recommendation R15-04 calls for TC to provide specific guidelines as to when grade separation at railway crossing should be considered. *Grade separation of Woodroffe, the Transitway and Fallowfield Road (R15-05)*: Recommendation R15-05 calls on the City of Ottawa to reconsider the need for grade separation at the Woodroffe Avenue, Transitway, and Fallowfield level crossing.
TSB News Conference on December 2, 2015	Also, the TSB held a news conference on December 2, 2015 to make public its report (R13T0192) on the investigation into the September 18, 2013, collision. The investigator in-charge, Mr. Bob Johnston, stated the following:

Report Title / Previous Studies	Summary of Findings and Recommendations
	"There is no evidence of any drugs, alcohol or fatigue, nor did any medical issue affect the driver's performance. The automated flashing lights, bells and gates at the crossing operated as designed. In fact, they were active for about 49 second before the bus struck the train. The operation of the train met company and regulatory requirements and it was slowing down as it approached the VIA Rail Fallowfield Station. The bus was well maintained, and the brakes were fully operational."
VIA Rail Canada and City of Ottawa Detailed Safety Assessment Report – December 2014	VIA Rail and the City of Ottawa retained CIMA Corporation to undertake detailed safety assessments for VIA Rail's Smiths Falls Subdivision. In addition to the safety assessment, each location was considered for a potential grade separation. CIMA stated that the most commonly used indicator used as an initial threshold for consideration of grade separation is the "Cross Product Indicator". It is calculated by the product of the Annual Average Daily Traffic (AADT) at the roadway and the number of trains per day. When this indicator is equal or greater than 200,000, consideration of grade separation should be initiated. The following summarize CIMA findings and recommendations related to grade separation. Recommendations related to safety improvements are outlined in Section 6 of CIMA's report. Merivale Road: City of Ottawa provided AADT for count year 2008 and count year 2013. CIMA estimated the AADT for 2010 and 2014 using growth rates calculated based on the AADT's provided by the City. Based on 2013 Daily Train Volume (DTV), the Cross Products for 2010 and 2014 were 139,139 and 415,875 respectively. Woodroffe Avenue: City of Ottawa provided AADT for count year 2010 and count year 2013. CIMA estimated the AADT for 2014 using growth rates calculated based on the AADT's provided by the City. Based on 2013 Daily Train Volume (DTV), the Cross Products for 2010 and 2014 were 236,599 and 518,825 respectively. Fallowfield Road: City of Ottawa provided AADT for count year 2010 and count year 2013. CIMA estimated the AADT for 2014 using growth rates calculated based on the AADT's provided by the City. Based on 2013 Daily Train Volume (DTV), the Cross Products for 2010 and 2014 were 166,111 and 442,566 respectively. Jockvale Road: City of Ottawa provided AADT for count year 2005 and count year 2014. CIMA estimated the AADT for 2010 using growth rates calculated based on the AADT's provided by the City. Based on 2013 Daily Train Volume (DTV), the Cross Products for 2010 and 2014 were 100,749 and 193,554 respectively.
Merivale Road (Slack Road to Prince of Wales Drive) and Fallowfield Road (Woodroffe Avenue to Prince of Wales Drive) Environmental Study MR C (ESR) Report – July 2004	The at-grade VIA Rail crossing of Merivale Road, located north of MacFarlane Road has been the subject of two studies, namely the Merivale Road-VIA Rail Grade Crossing Safety Assessment and the follow-up Merivale Road Grade Crossing Threshold Analysis. The latter identifies specific triggers and threshold criteria that are intended to provide early warning of the need to implement or initiate the detailed study of the implementation of specific

Report Title / Previous Studies	Summary of Findings and Recommendations
	engineering measures required to mitigate risks. Both reports are included under "Appendix E" of the ESR. The City of Ottawa Transportation Master Plan, 2003 indicated that the widening of Merivale Road between Slack Road and Amberwood Drive to four lanes with grade separation of the railway was planned to occur between 2013 and 2021 unless one of the following triggers occur which may move the grade separation earlier. The following summarizes the triggers (T) and early warnings (EW) for the grade separation: Collisions (T): A collision involving a train would trigger a detailed forensic investigation which may be used as a basis for deciding on the need for grade separation at this crossing. LOS (T): A reduced level of service (LOS) at the MacFarlane Road intersection would result in an increased number of queuing vehicles in the left-turn lane from southbound Merivale Road to MacFarlane Road. As storage space is limited in the turning lane vehicle queues would extend southbound through traffic to queue across the track. This would not be an acceptable solution. Network Changes (EW): Network changes creating increased AADT at the grade crossing result in an increased cross product warrant. This benchmark indicates that when the product of the AADT times the number of trains per day reaches 200,000, consideration should be given to a grade separation. Traffic Growth (EW): Traffic growth has a significant impact on each of the operational and network changes identified in the evolution of the Merivale Road and MacFarlane Road intersection. As a result, increase in traffic volumes should be monitored to determine the need for operational, road, and network improvements. Land Use Change (EW): Expansion of the South Merivale Business Park (South of Fallowfield Road intersection) is identified as an early warning criterion. The increased peak hour traffic volumes associated with further development of this facility would warrant the review of operational characteristics on Merivale Road and impacts on the immediate roadway network. Transit Operations (EW): The grade crossing safety assessment and City representatives have identified the following transit issues as significant safety concerns: Buses queuing on the tracks. Queues extending across the tracks due to vehicles stopped behind southbound buses that stop at the bus stop located just south of the tracks. Although relocating the MacFarlane Road intersection 100 m south of the grade crossing (completed in 2003) reduced the occurrence of these incidents, any changes to transit operations including bus frequency, bus types used (length), and routing should be assessed prior to their implementation to determine the possible need for any operational, road or network improvements which may be required to mitigate any increased risks associated with the change.

Report Title / Previous Studies	Summary of Findings and Recommendations
	Train Frequency (T): Increased train frequency (results in higher cross product discussed above). Train Speed (T): the need to evaluate the ability of the grade crossing warning system to accommodate higher train speeds, since the capacity of the system may be limited by its context of upstream and downstream grade crossing and track configurations Signal Warrant (EW): Warrant for traffic signals at MacFarlane is an early warning sign for grade separation. Cross Product (EW): As described above. The result of the above reports has been the recommendation for a grade separation in the north section of Merivale Road (Mile 1.63 of this study). Alignment alternatives for grade separation were generated. The following outlines the alternatives considered during the ESR development: 1. Merivale overpass of railway track 2. Railway over or underpass of Merivale Road 3. Merivale underpass of railway track along existing Merivale Road Alignment 4. Tunnel from Slack Road to Amberwood Drive 5. Potential lowering of rail and raising of Merivale 6. Potential lowering Merivale Road and raising railway 7. Merivale underpass of railway track on the existing VIA right-of-way (existing horizontal alignment was maintained) and 5.1 m vertical clearance was assumed. Alternatives 1 through 6 were screened out due un-acceptable impacts on Natural Environment, Socio-Economic Environment, Transportation, Land use, and costs. Alternative 7 was the selected alternative for the grade separation.
Southwest Transitway Extension And Woodroffe Widening – 1997, rev. 2004	There are significant changes to the existing conditions, and the report is not prepared in accordance with the current guidelines for the Class Environmental Assessment. Therefore, the recommendations outlined in this report will not be considered for this study.
Other previous studies (Geotechnical, structural, analysis, drainage, etc.)	In 2001, the City contracted Delcan Corporation (Delcan) to manage the proposed grade separation projects for Woodroffe Avenue, the Transitway, and Fallowfield Road. Delcan sub-contracted Golder Associates Limited (Golder) for a number of geotechnical studies in order to establish preliminary engineering guidelines and construction considerations related to the geotechnical aspects of the projects. In late 2001, Golder conducted preliminary geotechnical testing at the two proposed underpass locations to determine the general soil and groundwater conditions. A letter from CN to the City dated 08 May 2001, stated the following: CN would not permit permanent at-grade crossings at Fallowfield Road and Woodroffe Avenue due to the projected rail - road cross product, which is in excess of 200,000, and the current and future safety concerns, which justify the need for grade separated structures. Further justification is provided by VIA Rail's plan to add two daily trains and increase train speed. In addition, train volumes are expected to increase with plans for future commuter service.

Report Title / Previous Studies	Summary of Findings and Recommendations

	In July 2002, Golder conducted additional geotechnical testing to assess the hydrogeological properties of the bedrock, to estimate the pumping rates required to enable construction to take place, and to establish the potential impacts and design mitigation measures should they be required.
	
	In October 2002, VIA completed construction of the VIA Fallowfield Station and commenced with passenger service at this location. Since that time, all VIA trains along this route stop at the station. However, due to the signal circuitry in place at that time, the crossing protection on Woodroffe Avenue and Fallowfield Road, both of which were 2-lane roads at the time, remained activated while the trains were stopped.
	
	In November and December 2002, Golder submitted two reports, indicating that the preferred design option at each location was to have a roadway underpass as recommended by the EA. This design option would involve significant open-cuts for the roadway, related storm sewers for drainage, utility relocations and temporary detours for both vehicular and train traffic during construction. The open-cuts would be about 8 m (26.2 feet) below the structures. The structures would be 105 m to 115 m (344.5 feet to 377.3 feet) long, supported by 4 piers and 2 abutments at Woodroffe Avenue and at the Transitway, and 3 piers and 2 abutments at Fallowfield Road.
	
	In January of 2003, Golder submitted another report summarizing the additional geotechnical testing that was performed in July 2002. The report indicated that the roadway underpass option would likely involve pumping or recharging of large quantities of groundwater during construction and potentially throughout the life of the underpass. This option presented risks and significantly increased the cost of the projects from the original estimate of 40 million dollars to over 100 million dollars. The Golder report further indicated the following:
	
	• Once excavation of the permanently open-cut option is completed, the **pumping** would have to be maintained in order to prevent bottom heave and/or filling of the lower portion of the underpass.
	• Mitigation measures should be taken to reduce the effects of **water depletion** of the soils in the areas where buildings are present, due to the potential damage that could result from the consequent **settlement**.
	• The **impacts of depressurization** of the bedrock evaluated from the results of the pumping test and of the modeling are significant. The possible mitigating options and alternatives for grade separation included:
	  ➢ **bedrock grouting** and/or installation of **recharge wells** for temporary depressurization of the bedrock in conjunction with a watertight underpass structure;
	  ➢ raising the grades related to the grade separation; and
	  ➢ Construction of a **roadway overpass** in conjunction with a potential lowering of the railway.
	• It should be possible to adapt the design of the pumping and recharging to the site and maintain adequate groundwater conditions.
	• For a raised roadway underpass or a lowered railway grade option, any grade raise over 2 m (6.6 feet) required the use of **lightweight fill** to prevent overloading the grey clay on site.

Report Title / Previous Studies	Summary of Findings and Recommendations
	• A roadway overpass could be considered provided that **lightweight fill** would be used to construct the 9.2 m-high (30.2 feet) embankment approaches. In February 2003, Golder further indicated that with an open-cut underpass option, if a pumping interruption should occur at the site, the water table would rise rapidly in the bedrock and would result in slope instability and/or bottom heave of the road in the lower portion of the cut, which would also fill with water. Slope instability and bottom heave would begin to occur within minutes of the interruption. Following the Golder comments, Delcan indicated to the City that, because significant groundwater dewatering was required during the construction stage, if a pumping interruption was to occur, the risks could be potentially catastrophic and could include: • loss of all infrastructure constructed up to the time of a pumping interruption causing slope instability and/or bottom heave; • loss of utilities in the side slopes (water mains, gas main, hydro lines); • loss of the rail line; • loss of the roadway detours; • loss of residential and commercial property south of Fallowfield Road; and • Potential loss of life. Due to the risks identified, it was recommended that the open-cut option should not be pursued and that it was necessary to consider other alternatives.

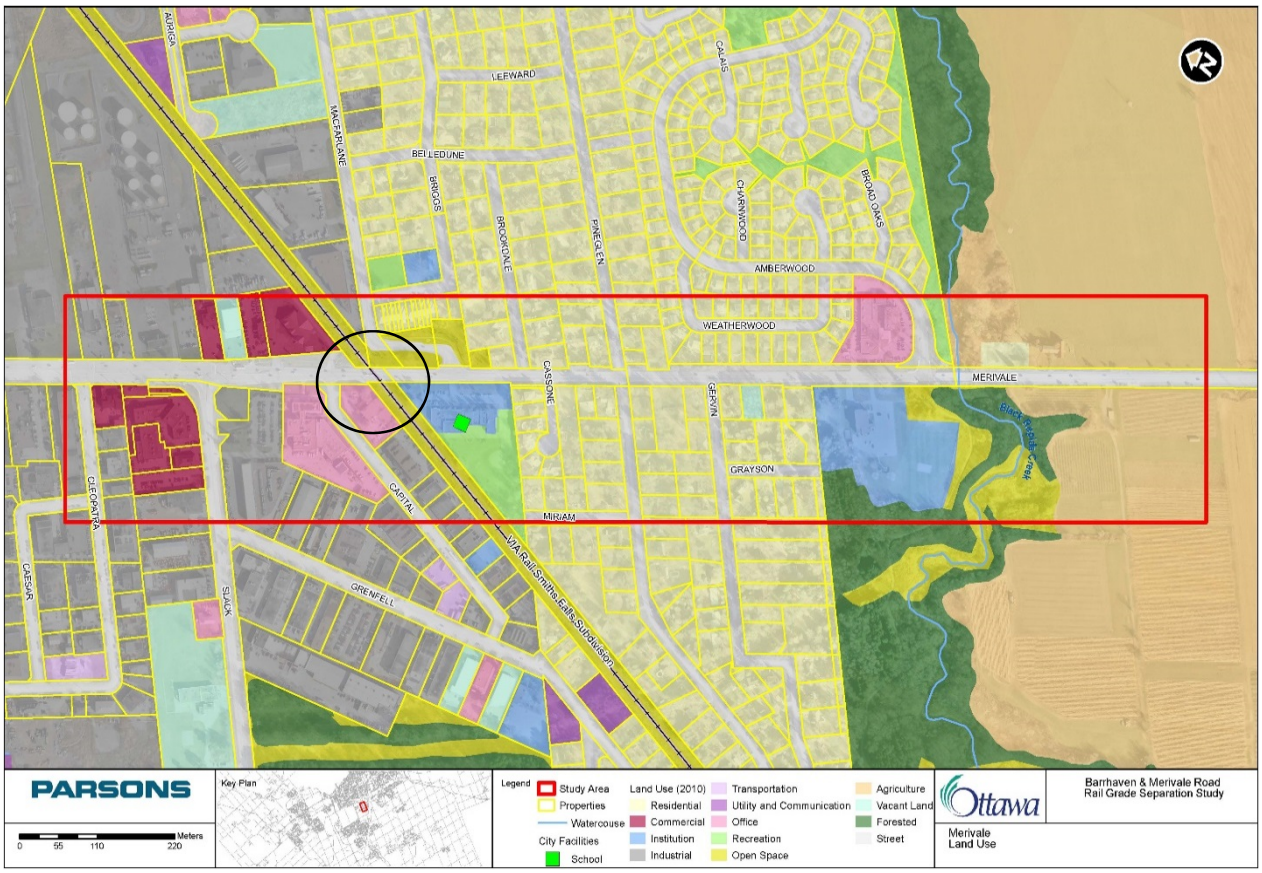
2.0 EXISTING ENVIRONMENTAL FEATURES

2.1 MERIVALE ROAD CROSSING

The Municipal Class EA titled: "*Merivale Road, Fallowfield Road Class EA Environmental Study Report"* completed by McCormick Rankin Corporation in July (2004) includes the rail crossing road section.

Figure 2 illustrates the study area limits for the Merivale Road Crossing and indicates the location of the Merivale Road crossing.

Figure 2: Merivale Road Crossing Study Area and Land Use



Note: Refer to Appendix G for full size diagram

2.1.1 SOCIAL ENVIRONMENT

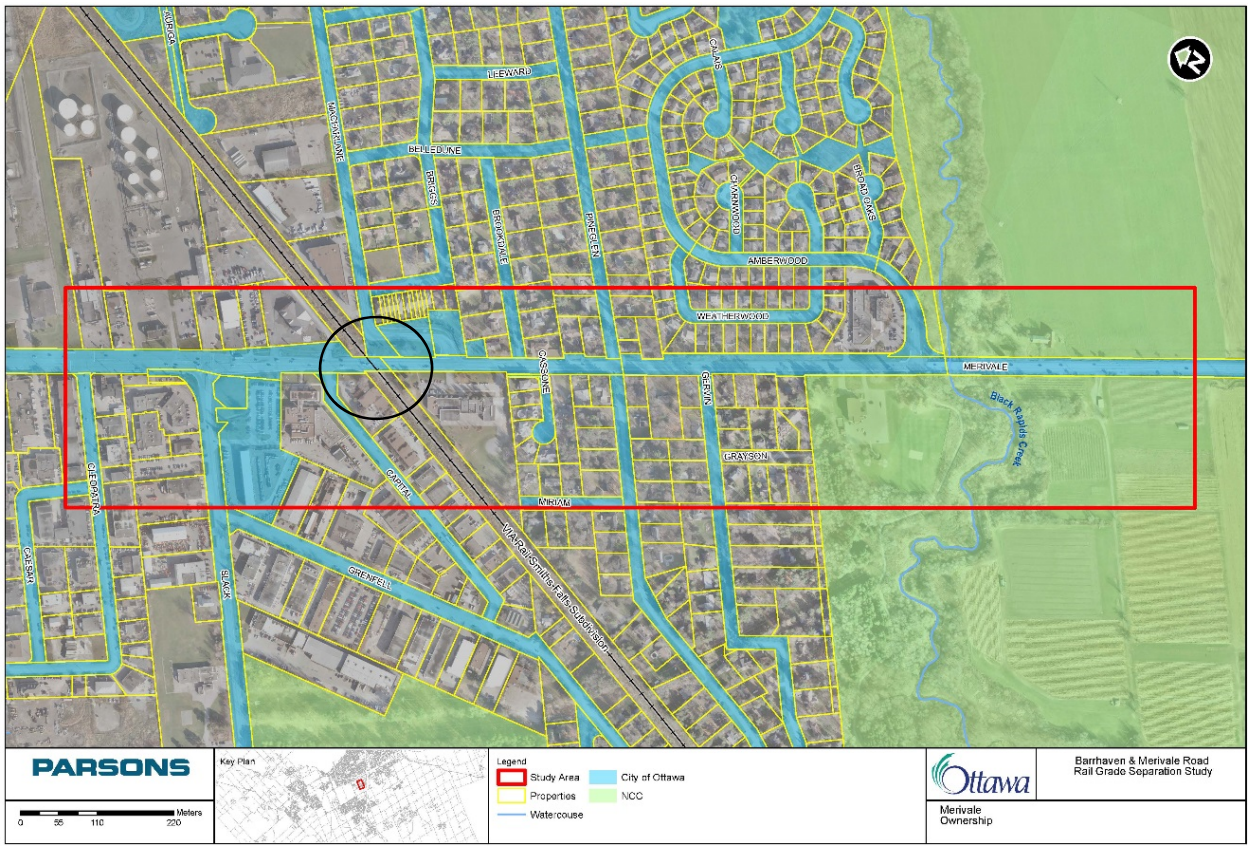
2.1.1.1 Existing Land Use

City facilities and existing land use for the Merivale Road study area are illustrated in **Figure 2: Merivale Road Crossing Study Area and Land Use**. Land use within the study area includes residential, and local businesses, as well as active recreational areas. Additionally, St. Monica School is located at the southwest corner of the crossing.

2.1.1.2 Land Ownership

The Merivale Road study area is composed of municipal and private land ownership. The National Capital Commission's (NCC) Greenbelt is located at far south end within the Merivale Road study area (**Figure 3**).

Figure 3: Land Ownership within the Merivale Road Study Area



Note: Refer to Appendix G for full size diagram

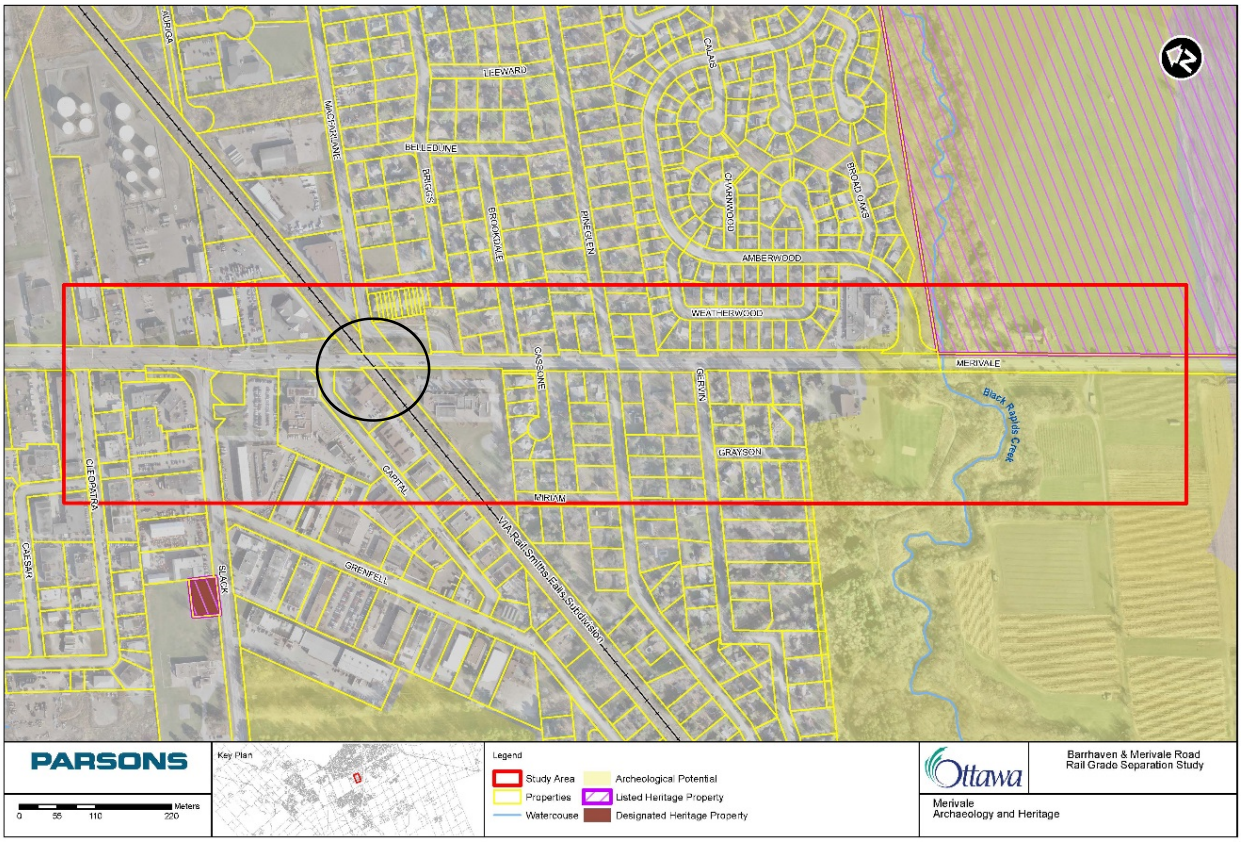
2.1.1.3 Archaeology and Heritage Resources

Figure 4 illustrates the extent of the City archaeological potential mapping and identifies one heritage property listed and designated outside of the study area. The property located at 2594 Prince of Wales Drive, located in the Greenbelt, is a listed heritage property partially located within the study area. Archaeological potential is identified within the study area, primarily within the NCC's Greenbelt south of Amberwood Crescent (City of Ottawa, 2016). No heritage properties are located within the vicinity of the crossing.

A Stage 1 Archaeological Assessment was completed in support of the Class EA (McCormick Rankin Corporation, 2004). No known archaeological sites were previously registered within the MRC 2004 study area limits which includes the immediate lands around the VIA Rail crossing pertaining to this study. The recommendations of the MRC 2004 study indicate that the lack of known archaeological sites could be the result of a lack of studies in the area (Archaeological Services Inc., 2004).

A Built Heritage and Cultural Landscape Assessment was also completed in support of the Class EA and found three cultural landscape units that also occur within the study area for this project (Archaeological Services Inc., 2004). Black Rapids Creek is considered a waterscape, the former CN, now VIA, rail line is a railscape and MacFarlane Road is a historic roadscape (Archaeological Services Inc., 2004).

Figure 4: Archeological Potential Mapping and Heritage Properties within the Merivale Road Study Area



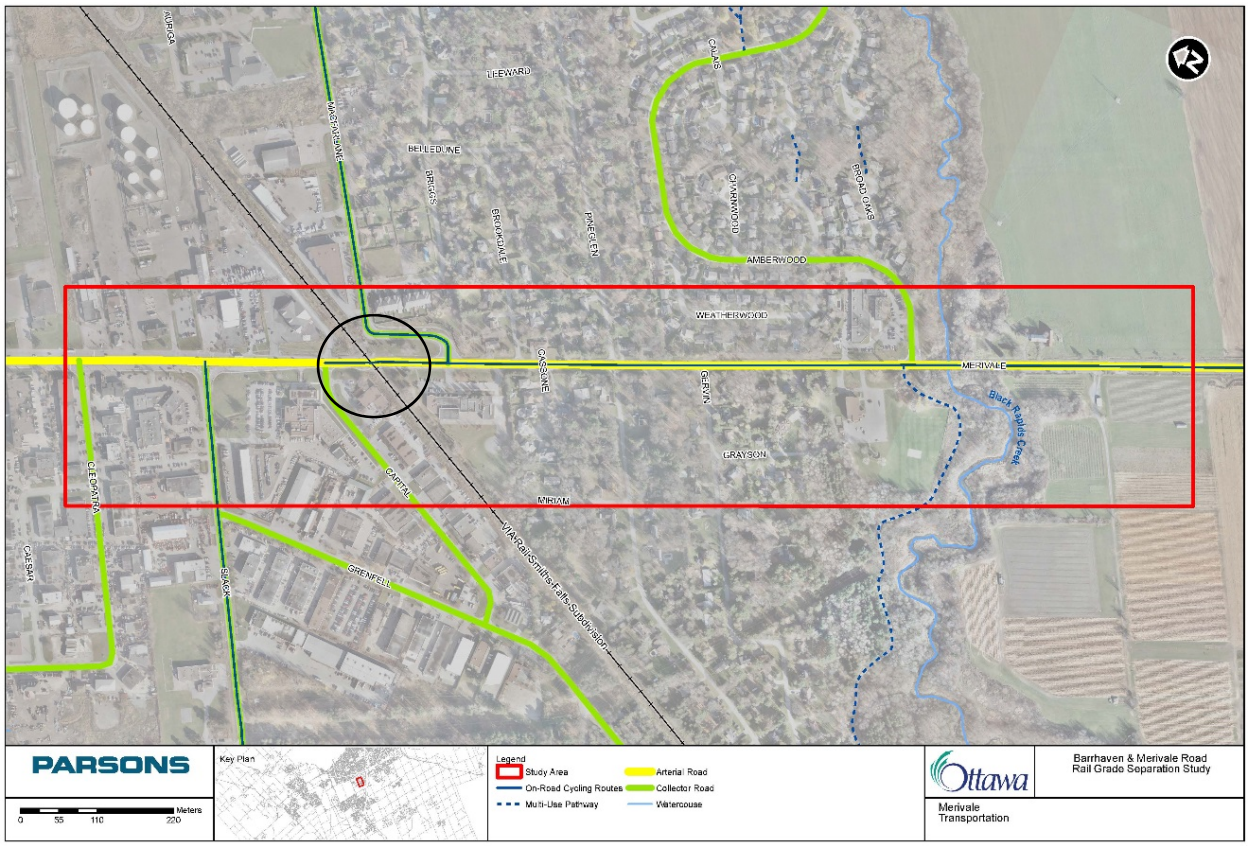
Note: Refer to Appendix G for full size diagram

2.1.2 PLANNING POLICIES

2.1.2.1 Transportation Master Plan, 2013

Transportation existing conditions are shown in **Figure 5** as designated in the City of Ottawa Official Plan (2013) and Transportation Master Plan (2013).

Figure 5: Transportation Network within the Merivale Road Study Area



Note: Refer to Appendix G for full size diagram

The City of Ottawa Official Plan (OP) designates Merivale Road as an Urban Arterial Road within the study area. Merivale Road is identified as a full load/year-round truck route. The TMP (City of Ottawa, 2013) does not identify any future projects for Merivale Road within the study area within the 2031 planning horizon.

Merivale Road is identified within the 2031 (concept) Rapid Transit and Transit Priority (RTTP) network as a transit priority corridor with continuous lanes, extending south into the study area and ending at Slack Road. For the remainder of the study area, additional bus stops are located along Merivale Road. No other RTTP projects within the study area are anticipated within the 2031 planning horizon.

2.1.2.2 Cycling and Pedestrian Plans, 2013

Presently, Merivale Road has sidewalks on the west side throughout the study area and on the east side from Slack Road to the north limit of the study area. Slack Road has sidewalks on the north side. Discontinuous sidewalks are found on Amberwood Crescent and MacFarlane Roads as well.

The City of Ottawa's Pedestrian Plan (City of Ottawa, 2013) does not identify any new pedestrian infrastructure to be constructed within the study area. The NCC has a planned new multi-use pathway on the east side of Merivale Road within the Greenbelt, north of Black Rapids Creek (not shown on the figure).

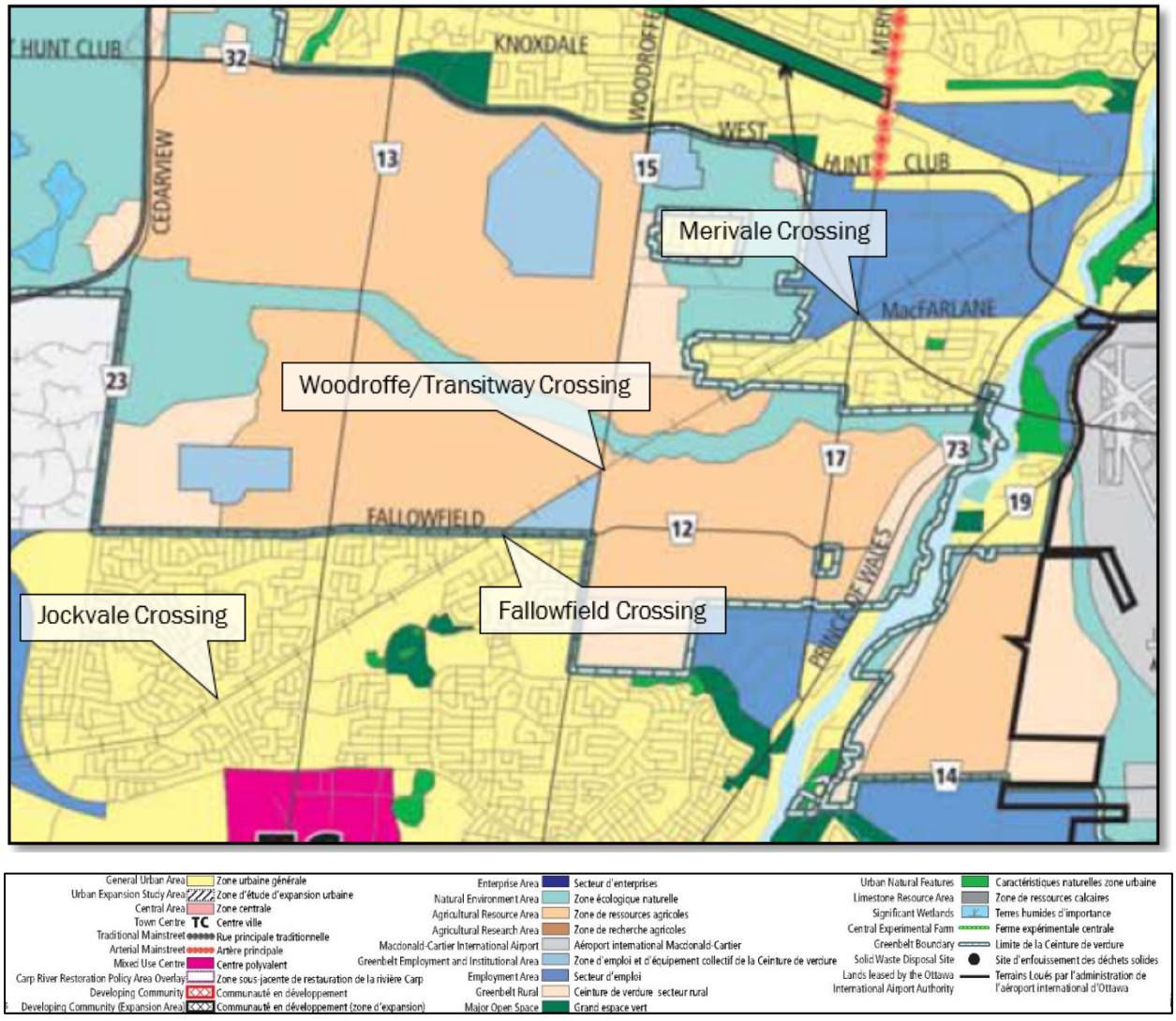
Merivale Road south of Capital Drive, Slack Road, and MacFarlane Road has paved shoulders that provide on-road cycling facilities. There is also an NCC-owned multi-use pathway on the west side of Merivale Road on the north side of Black Rapids Creek within the study area.

The Ottawa Cycling Plan (City of Ottawa, 2013) identified the addition of paved shoulders for cycling on MacFarlane Road planned for construction 2015-2018. They were constructed in 2016. The ultimate cycling network and TMP (City of Ottawa, 2013) identified Merivale Road as a spine route. A spine route designation is associated with dedicated on-road cycling space, ideally as either a cycling track or a buffered bike lane.

2.1.2.3 Ottawa Official Plan (2013, as amended)

The City of Ottawa Official Plan (OP) (2013) provides a vision of the future growth for the City of Ottawa as well as a policy framework to guide its development to the planning year 2031. The OP serves as a basis for, and provides guidance on, a wide range of municipal activities. It is a legal document that addresses matters of provincial interest defined by the Provincial Policy Statement (PPS). The study area for Merivale Road crossing is within the urban policy area as shown on Schedule B of the OP. Figure 6 illustrates the land use designations of the OP.

Figure 6: City of Ottawa Official Plan – Urban Policy Plan



Note: Refer to Appendix G for full size diagram

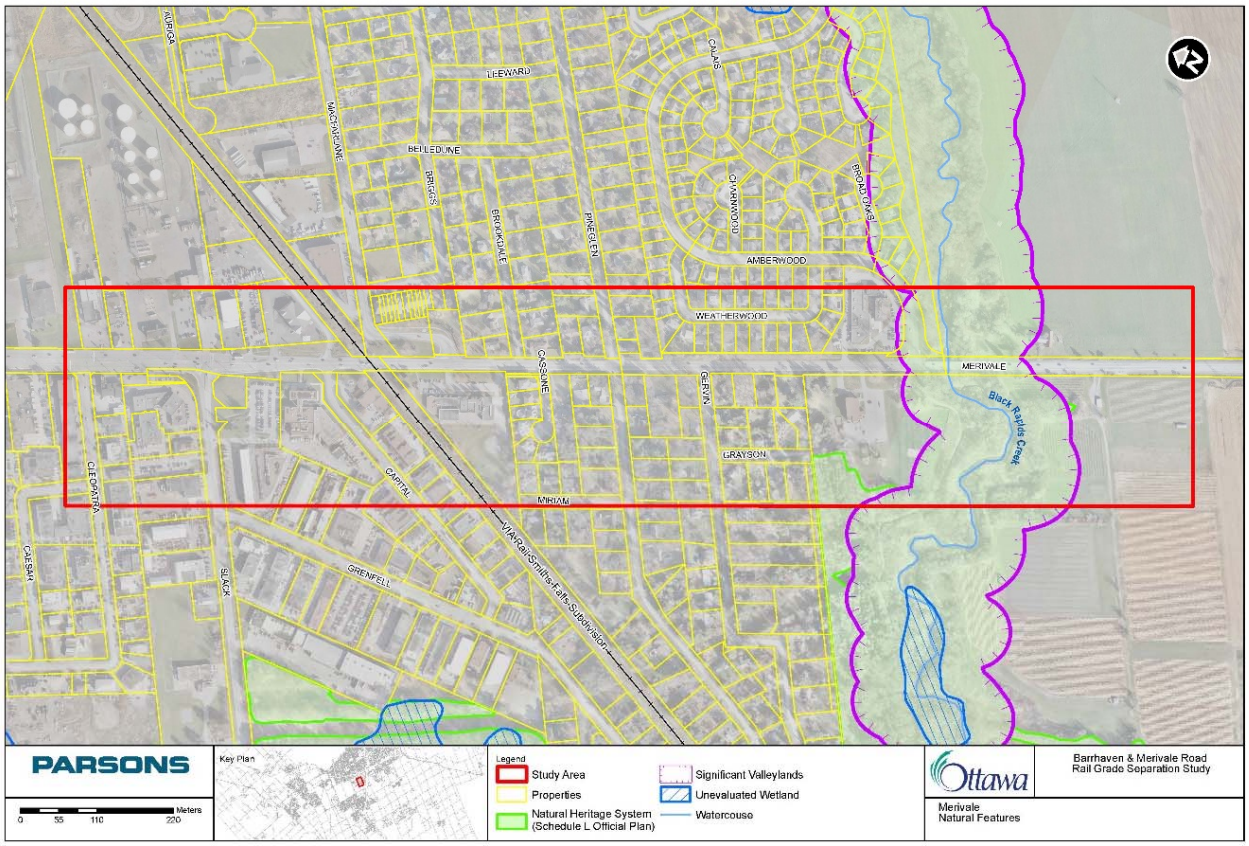
The Merivale Road study area includes the following designations:

- Employment area
- General urban area
- Natural environment area
- Agricultural resource area

2.1.3 NATURAL ENVIRONMENT

Natural environment features within the study area are shown on **Figure 7**.

Figure 7: Natural Environment Features within the Merivale Road Study Area



Note: Refer to Appendix G for full size diagram

Black Rapids Creek is classified as habitat for warm water bait fish in the vicinity of Merivale Road by the Rideau Valley Conservation Authority (RVCA) and this was verified by an aquatics investigation completed by Ecoplans Limited in 2002 (Ecoplans Limited, 2002). The creek is a permanent watercourse that flows eastward into the Rideau River. Consultation in 2002 with Ministry of Natural Resources (MNR) indicated the potential for the creek to provide spawning habitat for Northern Pike. Field surveys conducted ruled out this potential in the vicinity of Merivale Road (Ecoplans Limited, 2002). Black Rapids Creek is an environmentally sensitive area, part of the natural heritage system (Schedule L of the OP) located within the study area. Additionally, the area around Black Rapids Creek is identified as significant valley lands.

Vegetation in the study area is dominated by mown lawns and tolerant ornamental plantings at residences. The streetscape includes young to sub-mature trees that range in size from 15cm to over 50cm in diameter at breast

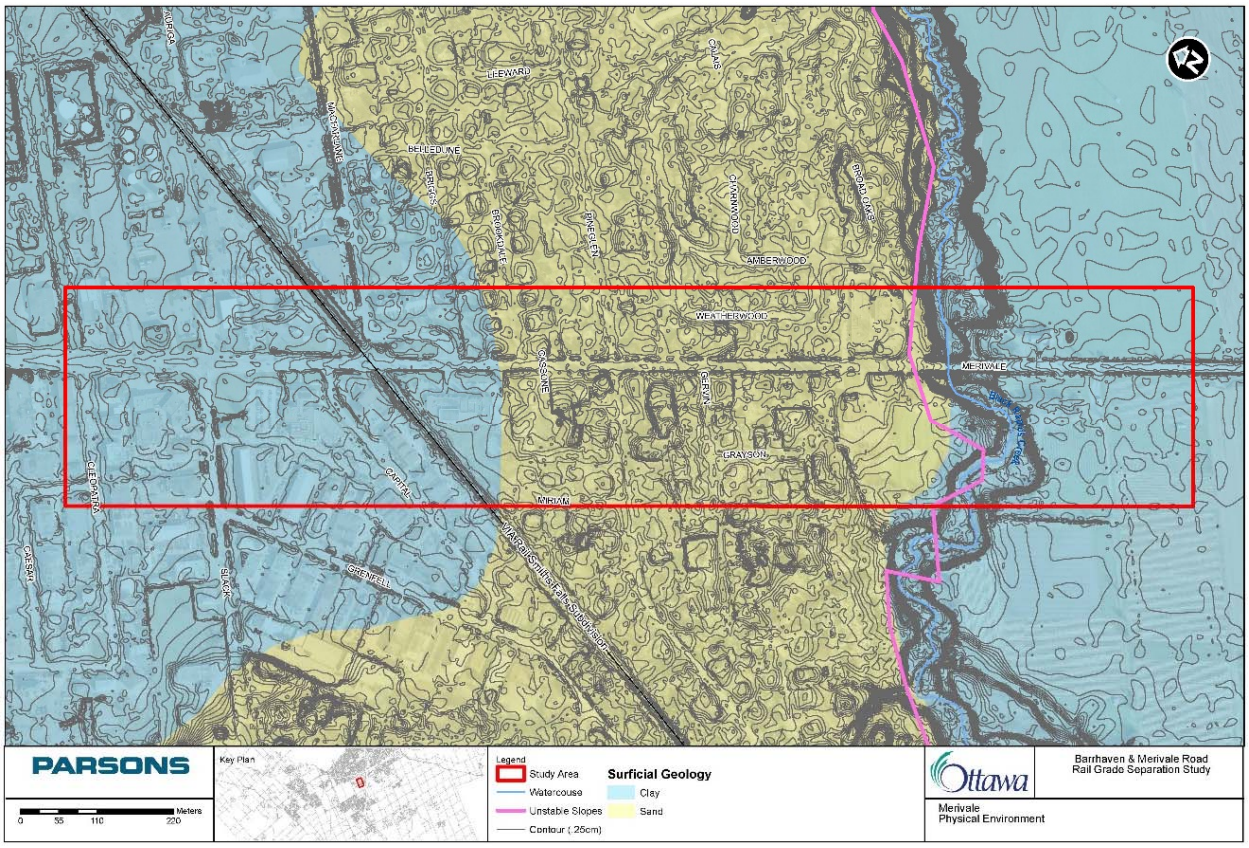
height and are in generally fair to good condition (Ecoplans Limited, 2002). A small amount of natural vegetation exists where Black Rapids Creek crosses under Merivale Road, located in the south portion of the study area.

Wildlife encountered during surveys and anticipated to be found in the study area are common, generalist species of birds and mammals that are tolerant of urban, semi-urban or disturbed conditions such as Black-capped Chickadee or raccoon (Ecoplans Limited, 2002). Black Rapids Creek is more likely to provide riparian linkage for wildlife movement (Ecoplans Limited, 2002).

2.1.4 PHYSICAL ENVIRONMENT

Geotechnical investigations completed to support the Class EA found that the study area is underlain by a deposit of silty clay approximately 2 m thick (Golder Associates Ltd., 2002). A sand deposit overlies the silty clay between approximately Pineglen Crescent and Amberwood Crescent (Golder Associates Ltd., 2002) (**Figure 8**). Bedrock is approximately at a depth of 8.5 to 9.5 meters below the ground surface and consists of sandstone and dolomite of the March formation (Golder Associates Ltd., 2002).

Figure 8: Physical Environment Features within the Merivale Road Study Area



Note: Refer to Appendix G for full size diagram

Geotechnical investigations also found specific bedding planes within the bedrock that exhibit high permeability which could affect domestic shallow wells in the Pineglen area (Golder Associates Ltd., 2002). Groundwater levels in the Pineglen area are shallow (Golder Associates Ltd., 2002).

Topography within the study area is generally flat outside of the Black Rapids Creek corridor (**Figure 8).** The creek contains unstable slopes within the study area.

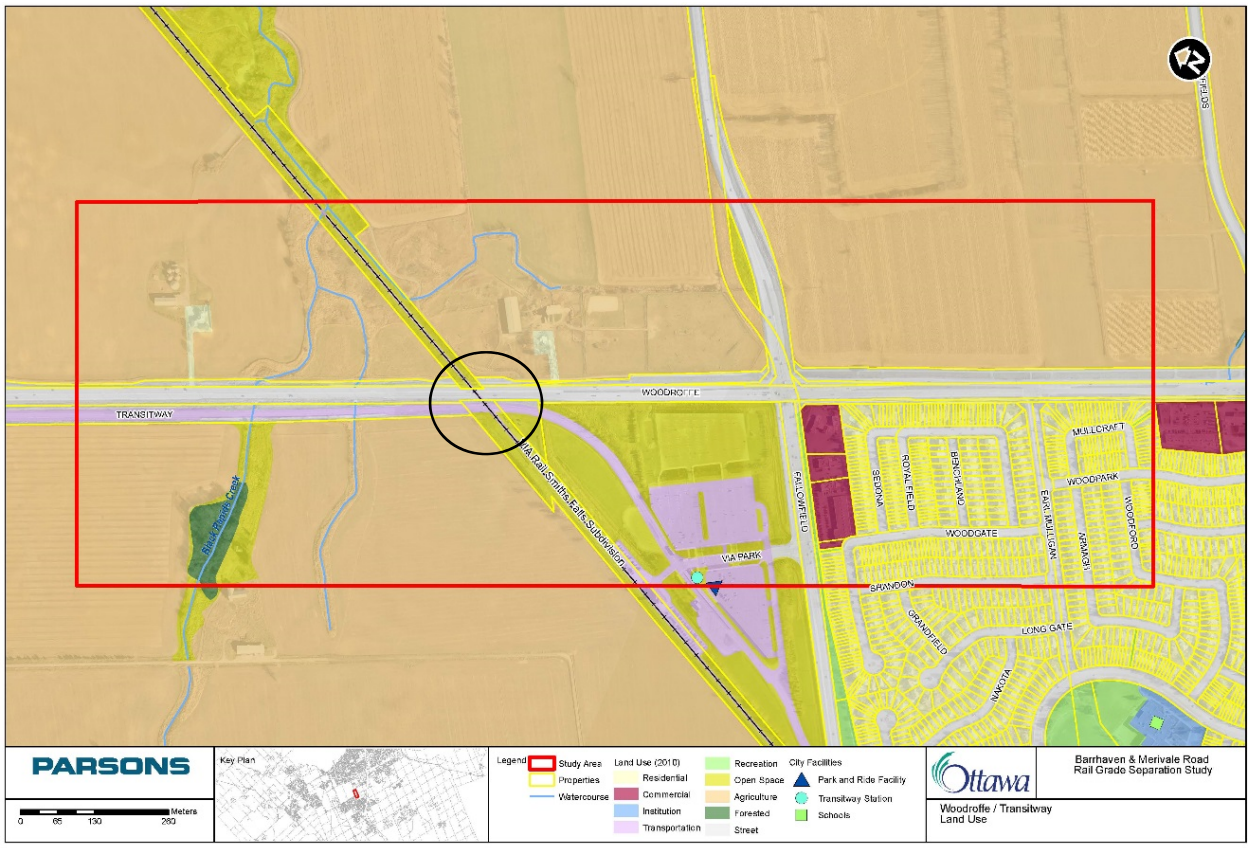
There is a high potential for soil contamination due to the type of businesses in the area (McCormick Rankin Corporation, 2004). This includes a local gas station, Ottawa's 'tank-farm', a fuel tanker cleaning facility and a former drycleaner site (McCormick Rankin Corporation, 2004).

2.2 WOODROFFE AVENUE/TRANSITWAY CROSSING

A municipal class EA report was completed that included part of the Woodroffe Avenue and Transitway VIA Rail crossing titled: *Southwest Transitway Extension Baseline Station to Strandherd Drive Environmental Assessment Report* completed by McCormick Rankin in December (1997). In addition, a Federal EA was completed titled: *Southwest Transitway Extension and Woodroffe Widening* completed by TSH in December (2004).

Figure 9 illustrates the study area limits for the Woodroffe Avenue/Transitway Crossing and indicates the location of the Woodroffe Avenue and Transitway crossings.

Figure 9: Woodroffe Avenue/Transitway Crossing Study Area and Land Use



Note: Refer to Appendix G for full size diagram

2.2.1 SOCIAL ENVIRONMENT

2.2.1.1 Existing Land Use

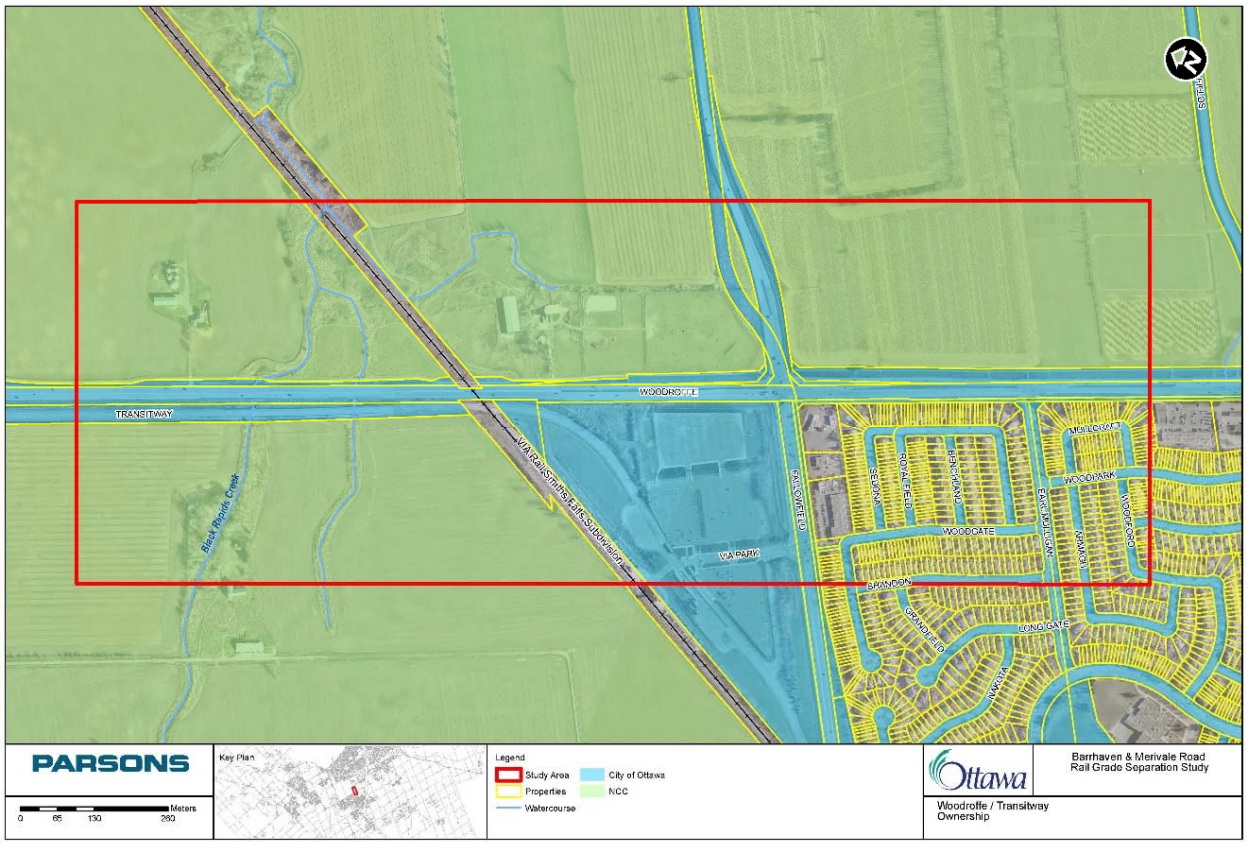
Existing land use is illustrated in **Figure 9** for the Woodroffe Avenue/Transitway study area.

The study area is located within the Barrhaven Business Improvement Association area. The Fallowfield Transitway station, VIA Rail station and a City park and ride facility are all located within the study area. Neighbourhood commercial and residential lands are located south of Fallowfield Road, west of Woodroffe Avenue. The Royale Equestrian Centre is located at the southeast corner of the Woodroffe Road crossing on NCC land.

2.2.1.2 Land Ownership

The NCC and the City of Ottawa own the majority of lands located within the Woodroffe Avenue/Transitway study area as shown in **Figure 10**.

Figure 10: Land Ownership within the Woodroffe Avenue/Transitway Study Area



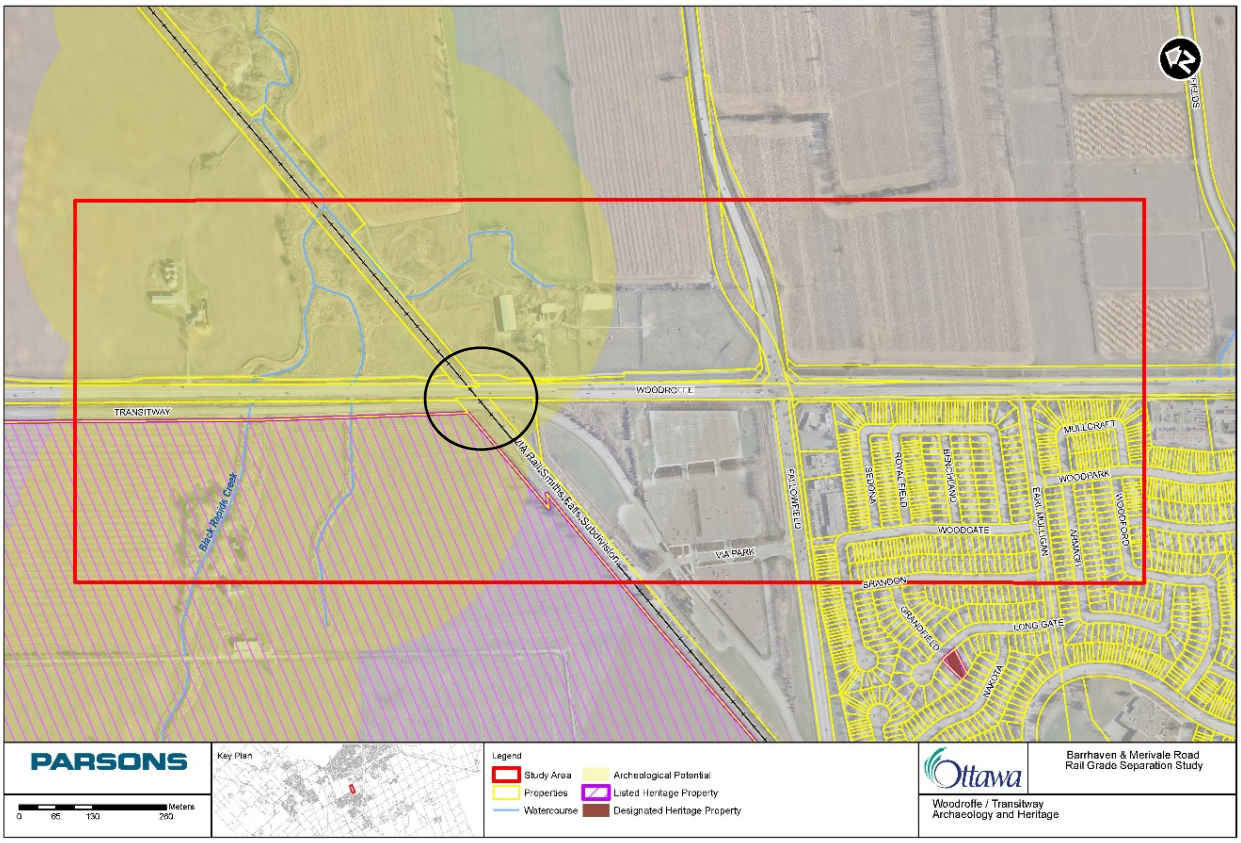
Note: Refer to Appendix G for full size diagram

2.2.1.3 Archaeology and Heritage Resources

Figure 11 illustrates the extent of the City archaeological potential mapping as well as the location of the one listed and designated heritage property outside of the study area. John Nesbitt House, located within the study area, in the Greenbelt, is a listed heritage property partially located within the study area.

A Stage 1/2 Archaeological Assessment was completed to support the Federal EA (TSH, 2004). NCC archaeological potential mapping identified areas with low archaeological potential including the immediate VIA Rail crossing location (Adams Heritage, 2004). Areas of potential were excavated and no significant evidence of archaeological sites was found (Adams Heritage, 2004). Further work was not recommended (Adams Heritage, 2004).

Figure 11: Archeological Potential Mapping and Heritage Properties: Woodroffe Avenue/Transitway Study Area



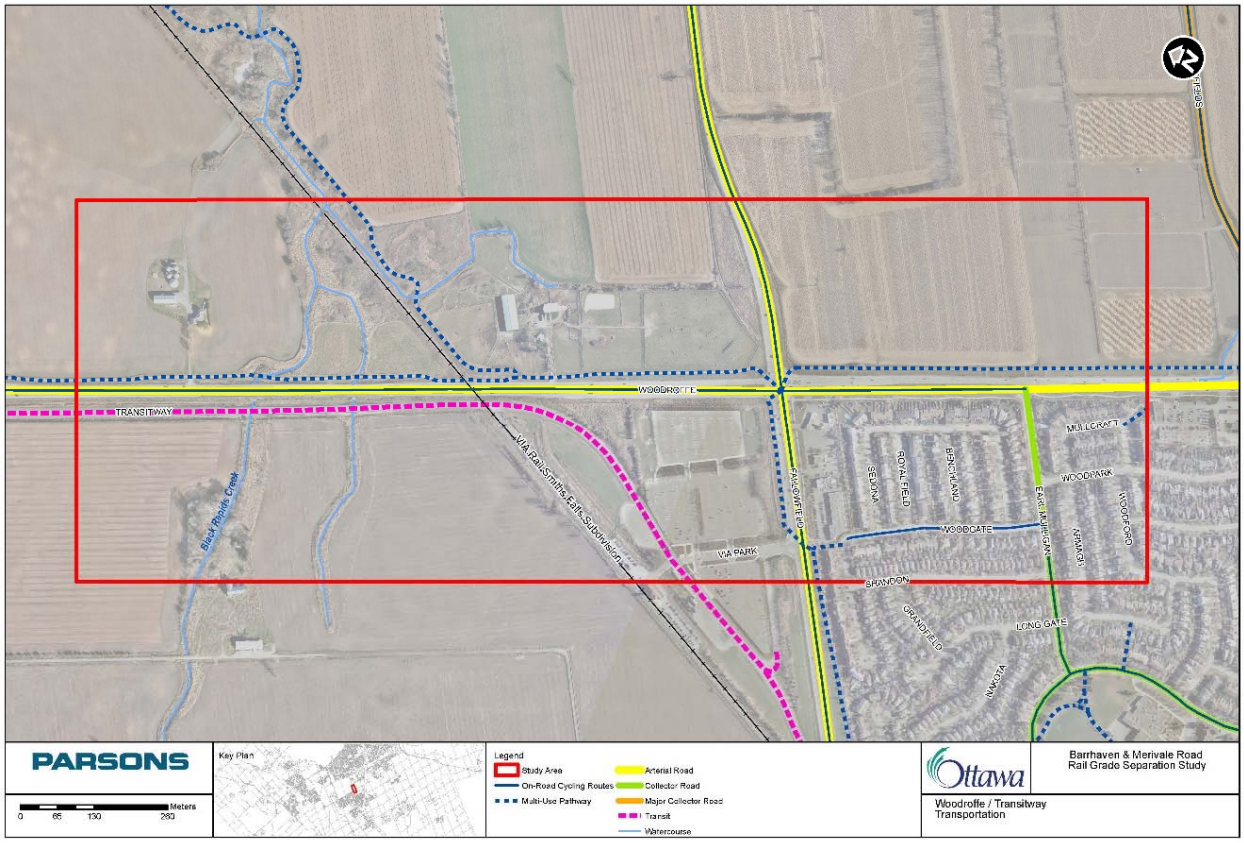
Note: Refer to Appendix G for full size diagram

2.2.2 PLANNING POLICIES

2.2.2.1 Transportation Master Plan, 2013

Transportation existing conditions are shown on **Figure 12** as designated in the City of Ottawa Official Plan (2013) and Transportation Master Plan (2013).

Figure 12 Transportation Network within the Woodroffe Avenue/Transitway Study Area



Note: Refer to Appendix G for full size diagram

Woodroffe Avenue is a designated arterial road within the study area. Woodroffe Avenue is identified by the City as a full load/year-round truck route. The TMP (City of Ottawa, 2013) does not identify any future projects for Woodroffe Avenue within the study area within the 2031 planning horizon.

The Transitway operates parallel to Woodroffe Avenue on the west side of the road. The ultimate RTTP network identifies conversion of the Transitway to grade separated light rail transit within the study area beyond the 2031 planning horizon.

2.2.2.2 Cycling and Pedestrian Plans, 2013

At present a concrete sidewalk extends from Via Park Place to Woodroffe. There is also an asphalt MUP on the north side of Fallowfield between Via Park and Woodroffe. The concrete sidewalk on the west side of Woodroffe extends south from Fallowfield (past Earl Mulligan Drive). Earl Mulligan Drive also has concrete sidewalks on both sides of the road. There is City owned asphalt multi-use pathway (MUP) on the east side of Woodroffe within the

study area limits. There is an asphalt MUP that extends westward from the Via Park Place intersection on the south side of Fallowfield and connects to the VIA Rail MUP on the east side of the VIA corridor. The City of Ottawa's Pedestrian Plan (City of Ottawa, 2013) does not identify any additional new pedestrian infrastructure to be constructed within the study area.

Woodroffe Avenue north of Fallowfield, Fallowfield Road north side and east of Woodroffe include paved shoulders that provide on-road cycling facilities within the study area.

The City's Cycling Plan (City of Ottawa, 2013) identifies the addition of a neighbourhood bikeway to be added north/south to the VIA/Transitway station in 2026-2031. The ultimate cycling network and TMP (City of Ottawa, 2013) identifies Woodroffe Avenue and Fallowfield Road within the study area as a spine route. A spine route designation is associated with a dedicated on-road cycling space, ideally as either a cycling track or a buffered bike lane. A potential future NCC MUP is to run on the north side of Fallowfield, west of VIA Park Place.

2.2.2.3 NCC's Greenbelt Master Plan, 2013

The Greenbelt Master Plan is one of several coordinating policy and development documents prepared by the NCC to guide both planning and the use of Federal Lands within the Greenbelt. One of the goals outlined in the Master Plan with respect to sustainable transportation and infrastructure involves ensuring that "environmental best management practices are applied in the design, operation and maintenance of existing infrastructure." Furthermore, the Plan highlights that new infrastructure within the Greenbelt should not be permitted "unless there is demonstration that there are no alternatives outside of the Greenbelt and no net loss will result to ecological or overall Greenbelt integrity."

The NCC emphasizes that preference will be given to sustainable, safe, and active transportation infrastructure that are in line with the vision, roles, and goals of the Greenbelt. Proponents of transportation structures should work closely with the NCC to ensure that Capital arrivals (including by railway) to the Greenbelt provide both a symbolic and a distinctive sense of place. Moreover, the continuity of recreational pathways and natural links should be maintained or enhanced within the planning, design, and function of transportation infrastructure.

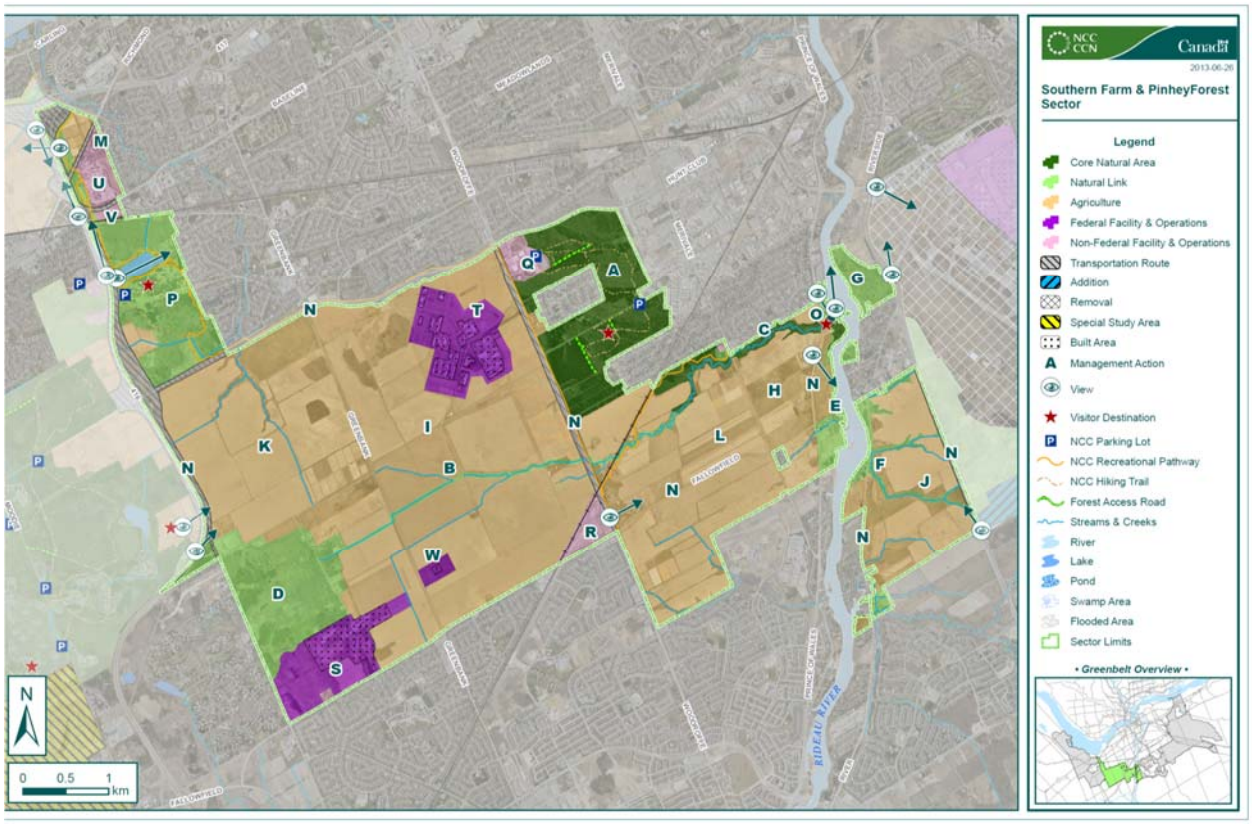
The study area for the Woodroffe Avenue/Transitway crossing is within or adjacent to three land use designations: 1) natural links, 2) agriculture and 3) non-federal facility and operations (**Figure 13**). The primary objectives of these three land use designations are outlined in **Table 2**.

Table 2: Greenbelt Master Plan Land Use Designations within the Woodroffe Avenue/Transitway Study Area

Land Use Designation	Primary Objectives
Natural Link	• Provide connections to the natural heritage system.
Agriculture	• Practice sustainable agriculture • Support productive Greenbelt farms that contribute to local and regional food supply • Diversify Greenbelt farming and provide opportunities for agri-tourism • Reduce the area covered by large mono-culture farming operations and promote diverse agriculture lands • Enhance Canada's Capital through conservation of natural visual landscapes
Non-Federal Facility and Operations	• Permit existing non-federal facilities, encouraging them to complement the Natural Environment, Agriculture, and Capital Experiences & Recreation roles of the Greenbelt • Enhance Canada's Capital by ensuring that Non-Federal Facilities in the Greenbelt contribute positively to the Greenbelt's visual landscapes. • Provide specific direction for sustainable design for edge facilities that interact with urban and Greenbelt landscapes, such as the Queensway-Carleton Hospital and the Nepean Sportsplex.

The Greenbelt Master Plan includes Sector Plans which provides more detailed information on the land use designations, Capital experiences, and the recreation networks in specific parts of the Greenbelt. The Southern Farm & Pinhey Forest Sector Plan is located within the study area.

Figure 13 NCC Greenbelt Master Plan - Southern Farm & Pinhey Forest Sector Plan



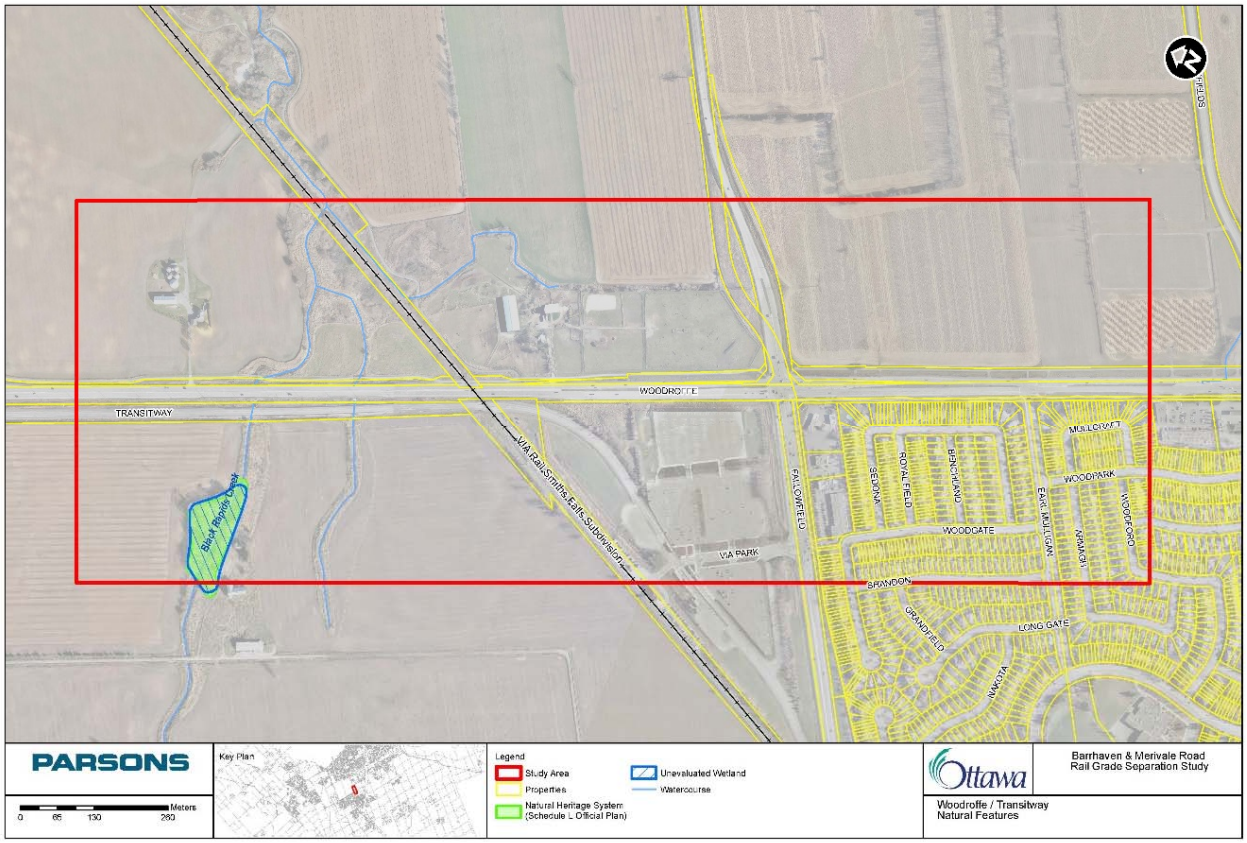
2.2.2.4 Ottawa Official Plan (2013, as amended)

The OP provides a vision of the future growth for the City of Ottawa as well as a policy framework to guide its development to the planning year 2031. The OP serves as a basis for, and provides guidance on, a wide range of municipal activities. It is a legal document that addresses matters of provincial interest defined by the PPS. The study area for Woodroffe Avenue/Transitway crossing is within the urban policy area as shown on schedule B of the OP as illustrated in **Figure 6**.

2.2.3 NATURAL ENVIRONMENT

Natural environment features within the study area are shown on **Figure 14**.

Figure 14: Natural Environment Features within the Woodroffe Avenue/Transitway Study Area



Note: Refer to Appendix G for full size diagram

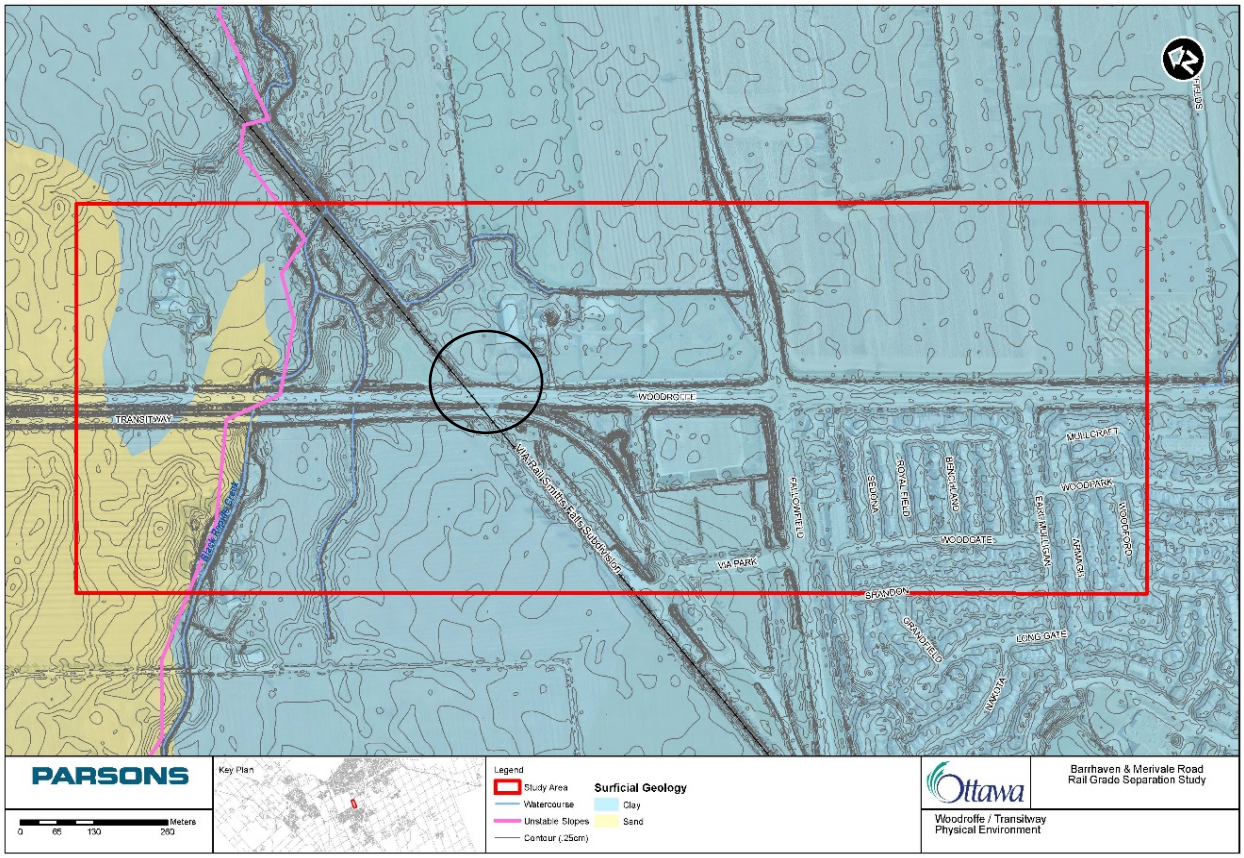
Black Rapids Creek is a permanent watercourse that flows north of the crossing under Woodroffe Avenue, flowing east through the NCC's Greenbelt agriculture lands and empties into the Rideau River. Black Rapids Creek is classified as habitat for warm water baitfish in the vicinity of Woodroffe Avenue by the Rideau Valley Conservation Authority and verified by aquatics investigation by EcoTec in 2003 (EcoTec Environmental Consultants, 2003). A small natural heritage system feature, identified as remnant woodland, is identified within the study area (Schedule L of the OP). This feature is also identified as an unevaluated wetland located within the Black Rapids Creek corridor. The Black Rapids Creek corridor is designated as a Natural Environment Area in Schedule B of the OP as previously mentioned and as a Natural Link in the NCC Greenbelt Master Plan.

Dominant vegetation in the vicinity of the crossing is active agriculture crops located entirely within the NCC's Greenbelt. There are narrow strips of mown lawn on either side of the road and some landscaped vegetation between the NCC's multi-use pathway and the edge of the agriculture fields that also contains some trees on the east side of Woodroffe Avenue.

2.2.4 PHYSICAL ENVIRONMENT

Surficial geology within the study area is nearly all clay with some sand near Black Rapids Creek (**Figure 15**). Mapping completed to support the Federal EA found bedrock geology in the area consists of sandstone and dolomite of the March formation (Jacques Whitford, 2004). Drift thickness and overburden varies in depth from 5 to 15m (Jacques Whitford, 2004). Groundwater in the area is approximately 4 to 5 meters below surface (McCormick Rankin, 1997).

Figure 15: Physical Environment Features within the Woodroffe Avenue/Transitway Study Area



Note: Refer to Appendix G for full size diagram

A Phase 1 Environmental Site Assessment was completed in support of the Federal EA process and no evidence of environmental contamination was found within the immediate VIA Rail crossing (Jacques Whitford, 2004). No further work was required (Jacques Whitford, 2004). However, because of the agriculture activities, should excess soil need to be disposed of off-site, testing will be required prior to disposal to ensure the soil does not contain pesticides and/or herbicides above approved levels (Jacques Whitford, 2004). If concentrations are above approved background levels, they will need to be disposed of in an MOECC approved landfill (Jacques Whitford, 2004).

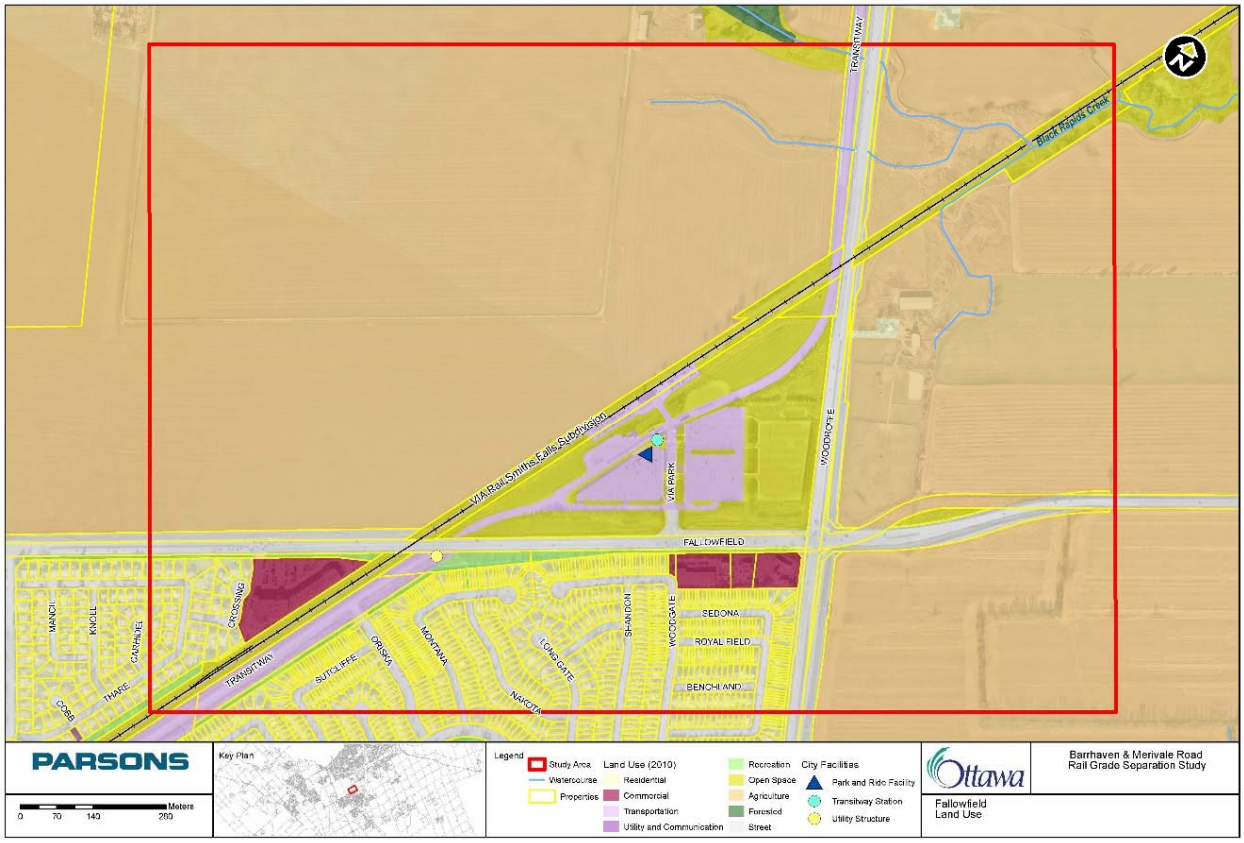
Topography within the study area is generally flat outside of the Black Rapids Creek corridor (**Figure 15**). Black Rapids Creek contains areas with unstable slopes.

2.3 FALLOWFIELD ROAD CROSSING

A municipal class EA report was completed that included part of the Fallowfield Road VIA Rail crossing titled: *Fallowfield Road Environmental Study Report"* completed by McCormick Rankin Corporation in October (1997).

Figure 16 illustrates the study area limits for the Fallowfield Road Crossing and indicates the location of the crossing.

Figure 16: Fallowfield Road Crossing Study Area and Land Use



Note: Refer to Appendix G for full size diagram

2.3.1 SOCIAL ENVIRONMENT

2.3.1.1 Existing Land Use

Existing land use is illustrated in **Figure 16** for the Fallowfield Road study area.

The Barrhaven Business Improvement Association is located within the study area. There is a regional shopping centre located at the southwest corner of the VIA Rail crossing. The crossing borders the Nepean South Secondary Plan and is within the 600m radius around transit stations.

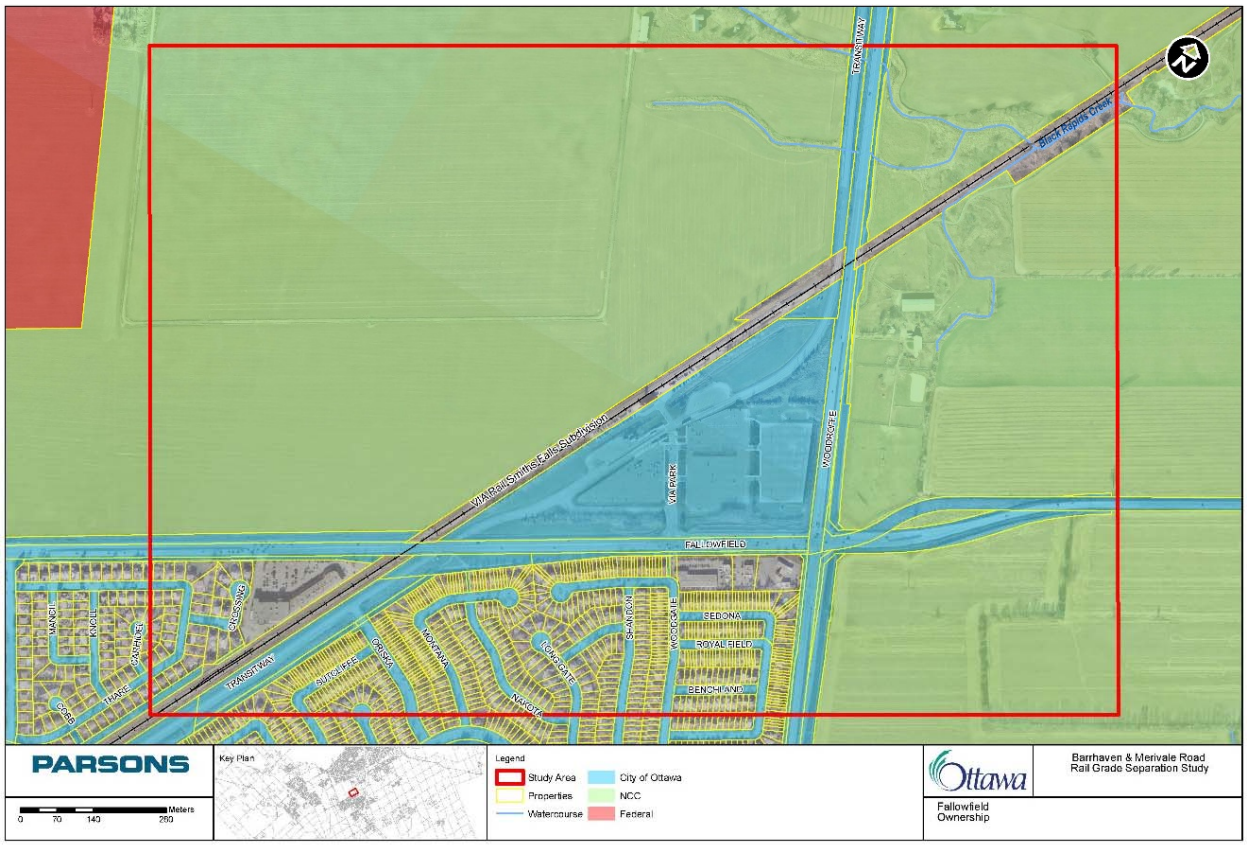
Community facilities within the study area are shown on **Figure 16**. Residential communities are located south of Fallowfield Road.

The Fallowfield Transitway station, VIA Rail station and a City park and ride facility are located within the study area. A traffic bunker (utility structure) is located on the south side of Fallowfield Road immediately east of the Transitway.

2.3.1.2 Land Ownership

NCC and City of Ottawa own lands located within the Fallowfield Road study area as shown in **Figure 17**.

Figure 17: Land Ownership within the Fallowfield Road Study Area

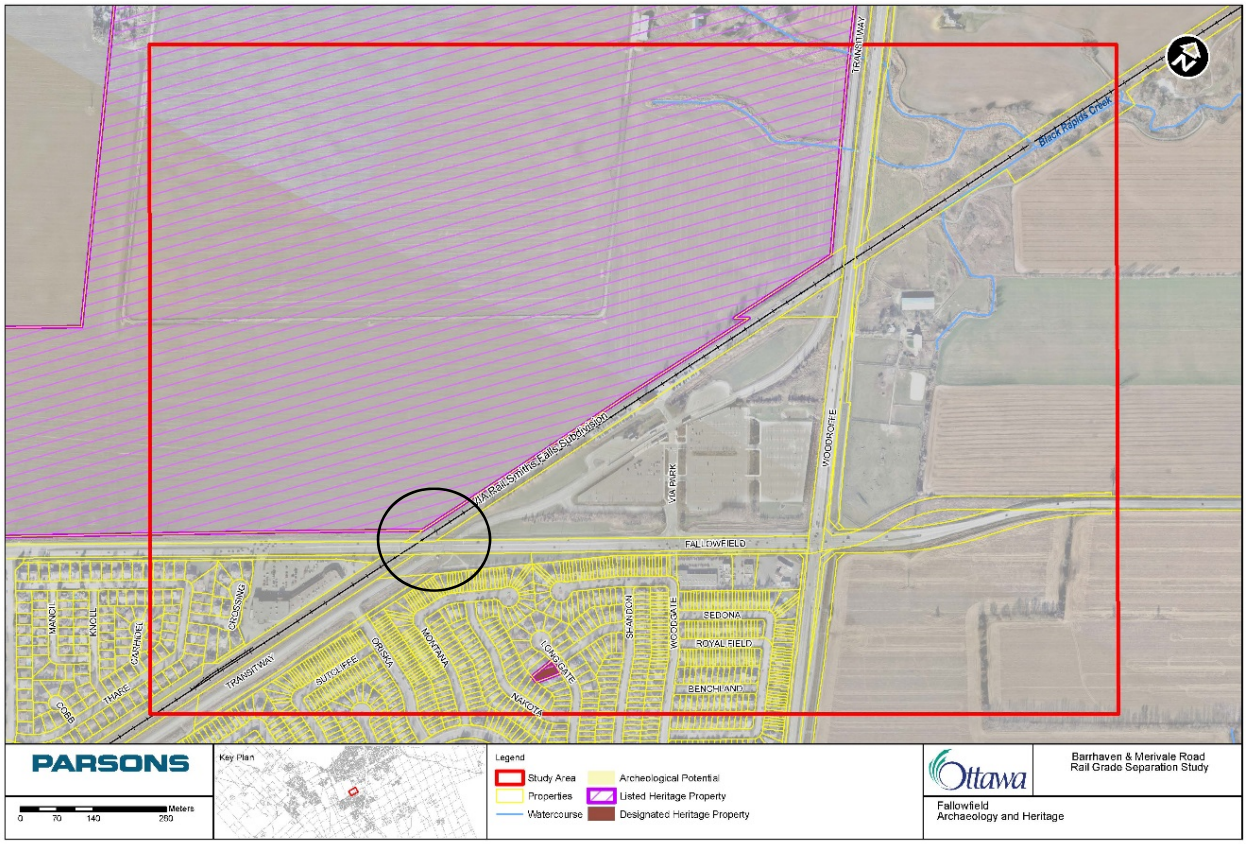


Note: Refer to Appendix G for full size diagram

2.3.1.3 Archaeology and Heritage Resources

Figure 18 illustrates the City archaeological potential mapping as well as the location of one heritage property that is listed and designated within the study area. Archaeological potential is identified within the study area, primarily within the NCC's Greenbelt north of the crossing (City of Ottawa, 2016). John Nesbitt House, located within the study area, in the Greenbelt, is a listed heritage property partially located within the study area.

Figure 18: Archeological Potential Mapping and Heritage Properties within the Fallowfield Road Study



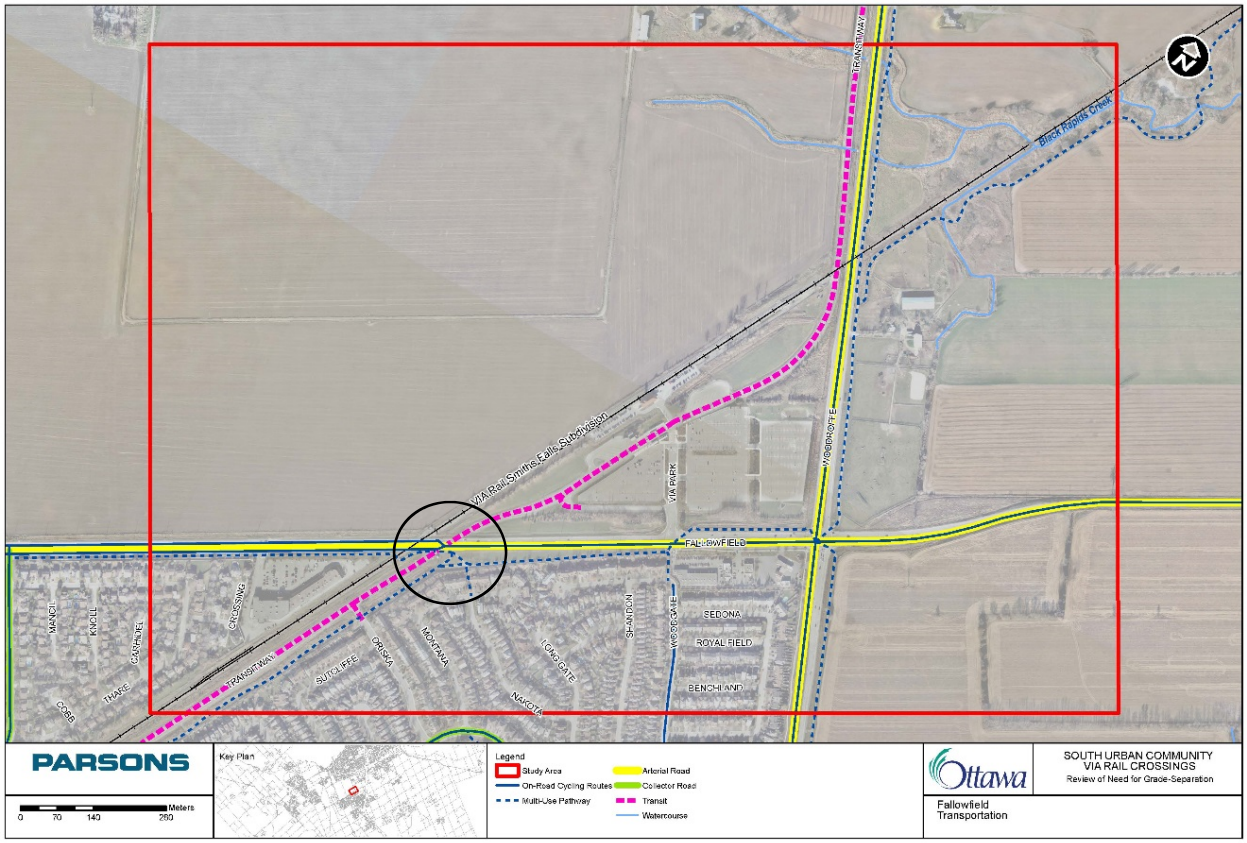
Note: Refer to Appendix G for full size diagram

2.3.2 PLANNING POLICIES

2.3.2.1 Transportation Master Plan, 2013

Transportation existing conditions are shown on **Figure 19** as designated in the City of Ottawa Official Plan (2013) and Transportation Master Plan (2013).

Figure 19: Transportation Network within the Fallowfield Road Study Area



Note: Refer to Appendix G for full size diagram

Fallowfield Road is a designated urban/rural Arterial Road within the study area and is a full load truck route. The TMP (City of Ottawa, 2013) does not identify any future projects for Fallowfield Road within the study area within the 2031 planning horizon. The Transitway intersects Fallowfield Road with a signalized intersection. The signalized intersection is interconnected to the at-grade rail crossing warning system, flashing lights, bells, and gates. Fallowfield Transitway station is located within the study area just northeast of the crossing. Bus stops are located along Fallowfield Road within the study area.

2.3.2.2 Cycling and Pedestrian Plans, 2013

Presently, Fallowfield Road has sidewalks on the south side within the study area from Woodroffe Avenue to Woodgate Way. Woodroffe Avenue has sidewalks on the west side from Fallowfield Road to the south limit of the study area. Woodgate Way has sidewalks on the east side of the road. Woodroffe Avenue has a parallel City-owned multi-use pathway throughout the study area's east side. Fallowfield Road has a parallel City-owned multi-use pathway on the south side of the road from Woodgate Way to the west limit of the study area and on the southeast

side of the Transitway. An NCC-owned multi-use pathway extends on the south side of the VIA Rail line from the northeast and connects to the city multi-use pathway at Woodroffe Avenue.

The City of Ottawa's Pedestrian Plan (City of Ottawa, 2013) does not identify any new pedestrian infrastructure to be constructed within the study area.

Fallowfield Road has on-road cycling facilities consisting of paved shoulders on the north side from the VIA Rail crossing to the western limit of the study area and an on-road bike lane on the south side from Woodroffe Avenue to the western limit of the study area. Woodroffe Avenue and Woodgate Way have paved shoulders that provide on-road cycling facilities within the study area. The NCC noted the potential for an extension of the multi use path for Via Park to the west.

The City's Cycling Plan (City of Ottawa, 2013) identifies the addition of a neighbourhood bikeway to be added north/south to VIA Rail/Transitway station in 2026-2031. The ultimate cycling network and TMP (City of Ottawa, 2013) identifies Fallowfield Road and Woodroffe Avenue within the study area as a spine route. A spine route designation is associated with dedicated on-road cycling space, ideally as either a cycling track or a buffered bike lane.

2.3.2.3 NCC's Greenbelt Master Plan, 2013

The Greenbelt Master Plan is one of several coordinating policy and development documents prepared by the NCC to guide both planning and the use of Federal Lands within the Greenbelt. One of the goals outlined in the Master Plan with respect to sustainable transportation and infrastructure involves ensuring that "environmental best management practices are applied in the design, operation and maintenance of existing infrastructure." Furthermore, the Plan highlights that new infrastructure within the Greenbelt should not be permitted "unless there is demonstration that there are no alternatives outside of the Greenbelt and no net loss will result to ecological or overall Greenbelt integrity."

The NCC emphasizes that preference will be given to sustainable, safe, and active transportation infrastructure that are in line with the vision, roles, and goals of the Greenbelt. Proponents of transportation structures should work closely with the NCC to ensure that Capital arrivals (including by railway) to the Greenbelt provide both a symbolic and a distinctive sense of place. Moreover, the continuity of recreational pathways and natural links should be maintained or enhanced within the planning, design, and function of transportation infrastructure.

The study area for the Fallowfield crossing is within or adjacent to three land use designations: 1) natural links, 2) agriculture and 3) non-federal facility and operations (**Figure 13**). The primary objectives of these three land use designations are outlined in **Table 3**.

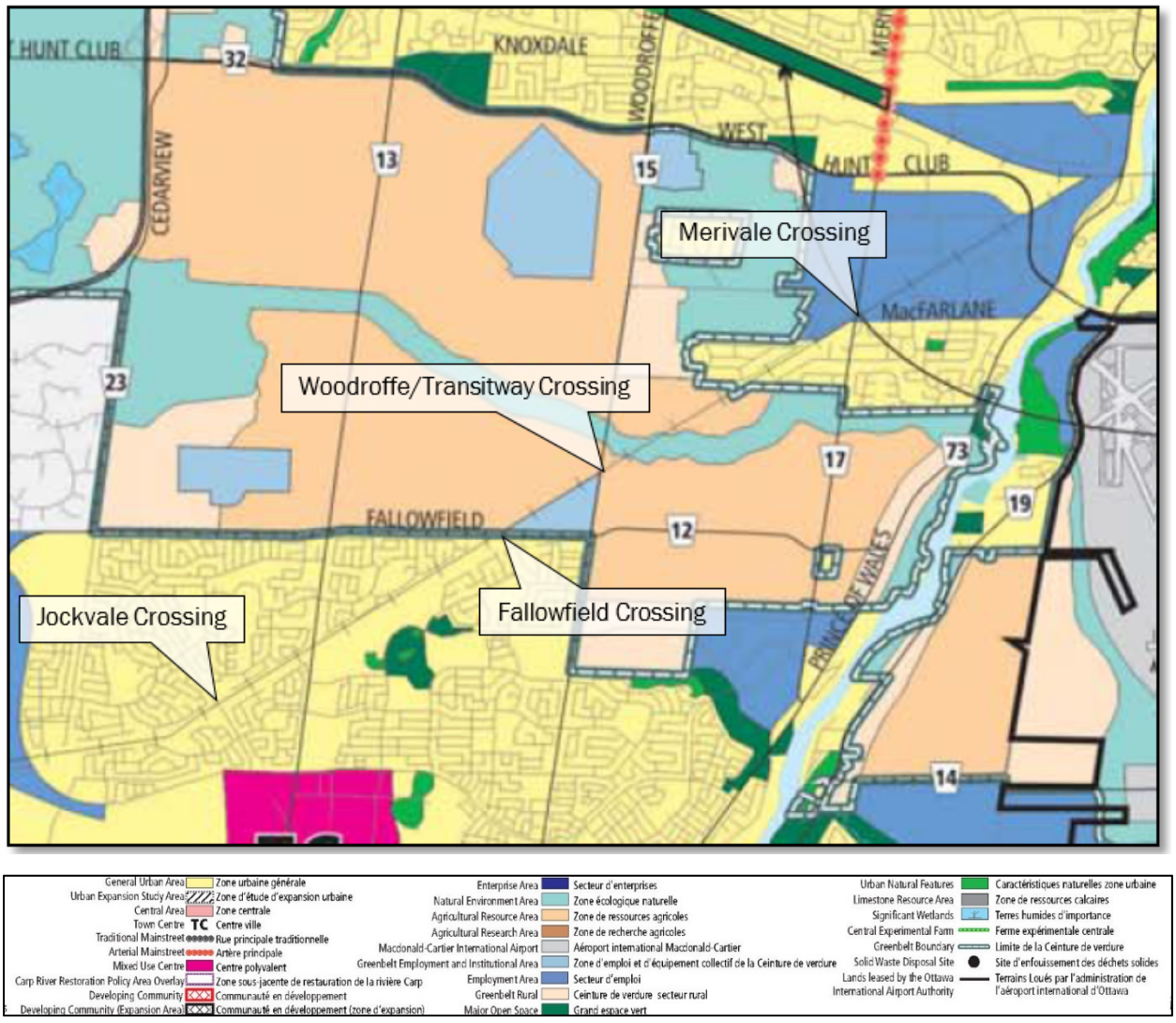
Table 3: Greenbelt Master Plan Land Use Designations within the Fallowfield Road Study Area

Land Use Designation	Primary Objectives
Natural Links	• Provide connections to the natural heritage system.
Agriculture	• Practice sustainable agriculture • Support productive Greenbelt farms that contribute to local and regional food supply • Diversify Greenbelt farming and provide opportunities for agri-tourism • Reduce the area covered by large mono-culture farming operations and promote diverse agriculture lands • Enhance Canada's Capital through conservation of natural visual landscapes
Non-Federal Facility and Operations	• Permit existing non-federal facilities, encouraging them to complement the Natural Environment, Agriculture, and Capital Experiences & Recreation roles of the Greenbelt • Enhance Canada's Capital by ensuring that Non-Federal Facilities in the Greenbelt contribute positively to the Greenbelt's visual landscapes. • Provide specific direction for sustainable design for edge facilities that interact with urban and Greenbelt landscapes, such as the Queensway-Carleton Hospital and the Nepean Sportsplex.

The Greenbelt Master Plan includes Sector Plans which provides more detailed information on the land use designations, Capital experiences, and the recreation networks in specific parts of the Greenbelt. The Southern Farm & Pinhey Forest Sector Plan is located within the study area (**Figure 13**).

2.3.2.4 Ottawa Official Plan (2013, as amended)

The OP provides a vision of the future growth for the City of Ottawa as well as a policy framework to guide its development to the planning year 2031. The OP serves as a basis for, and provides guidance on, a wide range of municipal activities. It is a legal document that addresses matters of provincial interest defined by the PPS. The study area for Fallowfield Road crossing is within the urban policy area as shown on Schedule B of the OP. **Figure 6**: City of Ottawa Official Plan – Urban Policy Plan



The Fallowfield Road study area includes the following designations:

- General urban area
- Natural environment area
- Greenbelt employment and institutional area
- Agricultural resource area

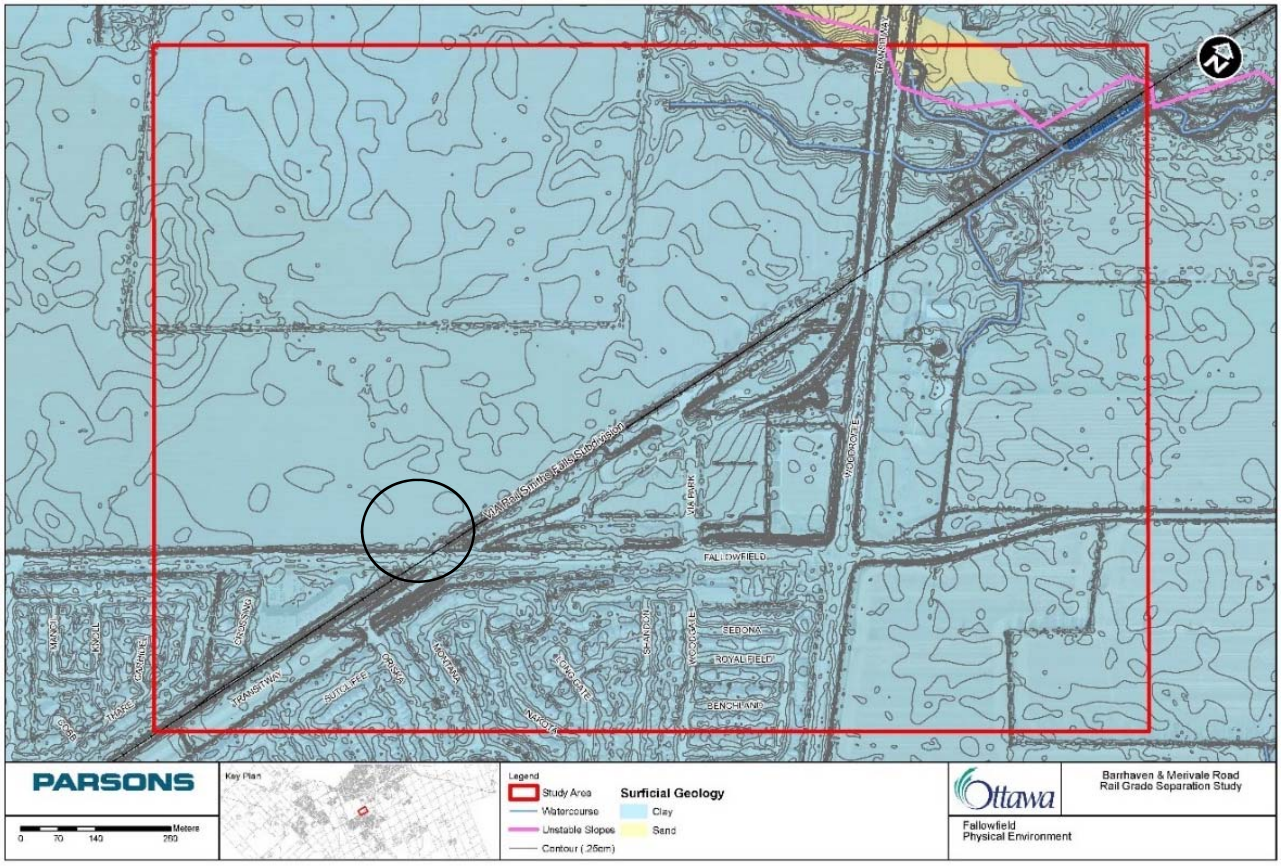
2.3.3 NATURAL ENVIRONMENT

Black Rapids Creek is a permanent watercourse that flows eastward into the Rideau River. There are no other natural heritage features within the Fallowfield Road study area.

2.3.4 PHYSICAL ENVIRONMENT

Surficial geology within the study area is nearly all clay with some sand near Black Rapids Creek **Figure 20**. Topography within the study area is generally flat outside of the Black Rapids Creek corridor. Black Rapids Creek contains areas with unstable slopes.

Figure 20: Physical Environment Features within the Fallowfield Road Study Area



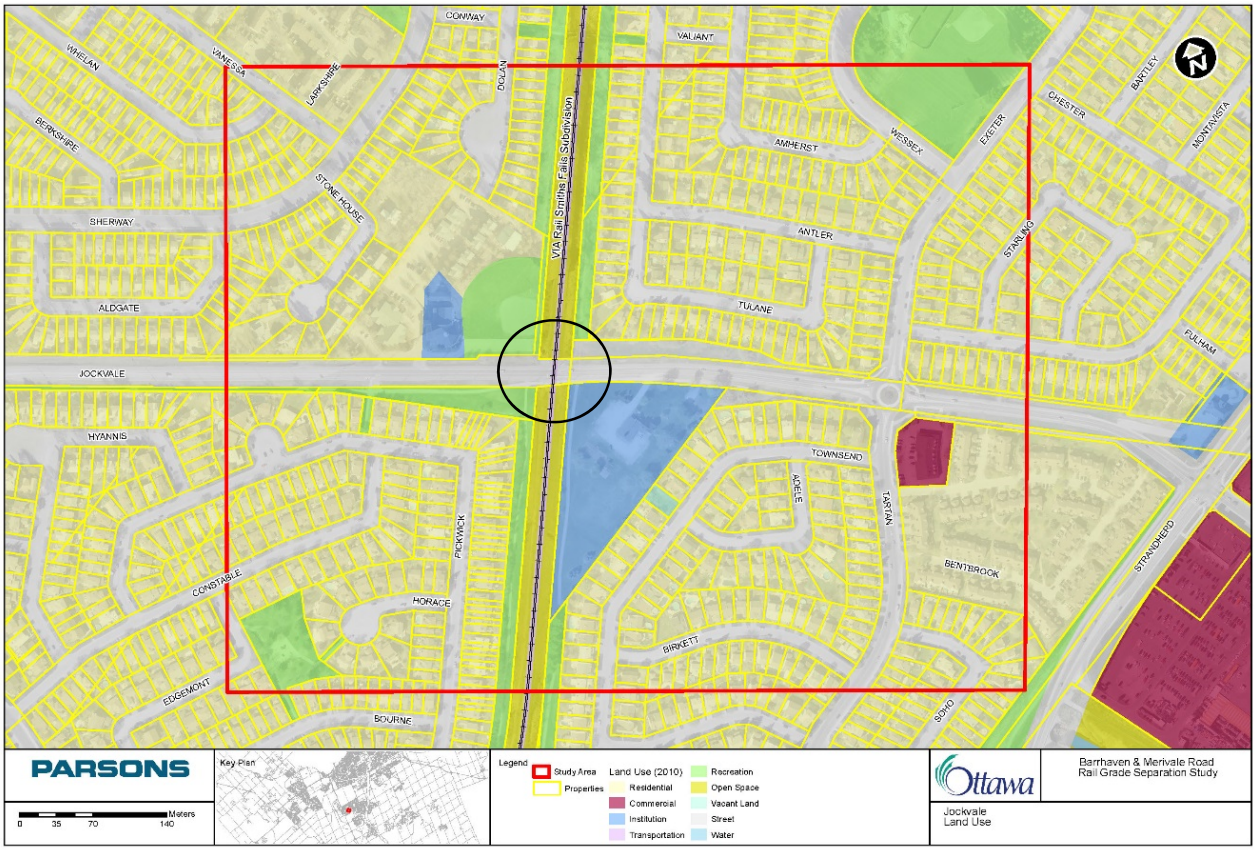
Note: Refer to Appendix G for full size diagram

2.4 JOCKVALE ROAD CROSSING

No municipal class EA report has been completed for the consideration of grade separation at the Jockvale Road VIA Rail crossing.

Figure 21 illustrates the study area limits for the Jockvale Road Crossing and indicates the location of the Jockvale Road crossing.

Figure 21: Jockvale Road Crossing Study Area and Land Use



Note: Refer to Appendix G for full size diagram

2.4.1 SOCIAL ENVIRONMENT

2.4.1.1 Existing Land Use

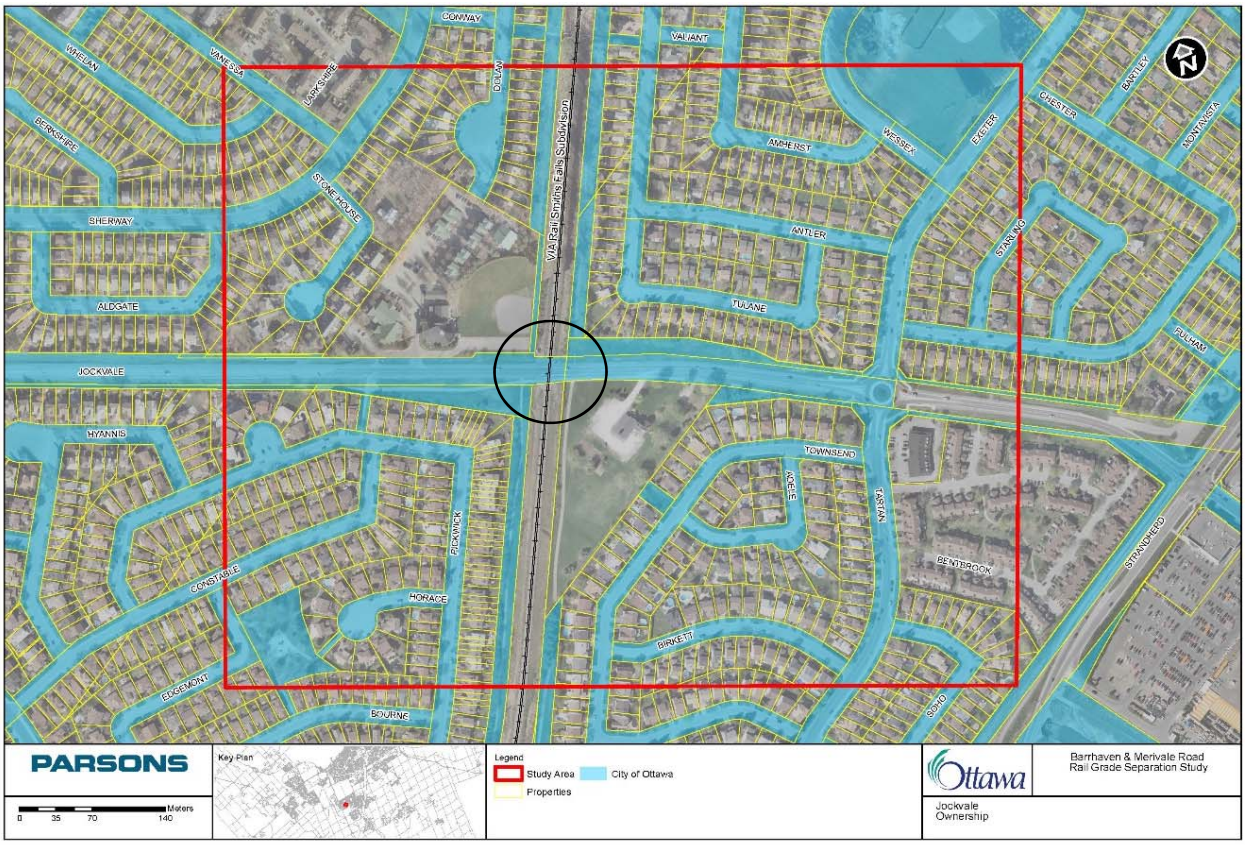
Existing land use is illustrated in **Figure 21** for the Jockvale Road study area. There are residences within 50m of the crossing as well as a licensed child care centre located on the northwest side of the crossing. There is also a church on the southeast side of the crossing.

The crossing is near several community parks including: Parkland corridors on both sides of the VIA alignment and both sides of Jockvale Road. Pathway Links are located along Jockvale Road. Horace Park, Moloughney Park, Burnett Park and Houlahan Park are located within 500m of the crossing.

2.4.1.2 Land Ownership

City of Ottawa and privately owned lands are located within the Jockvale Road study area as shown in **Figure 22**.

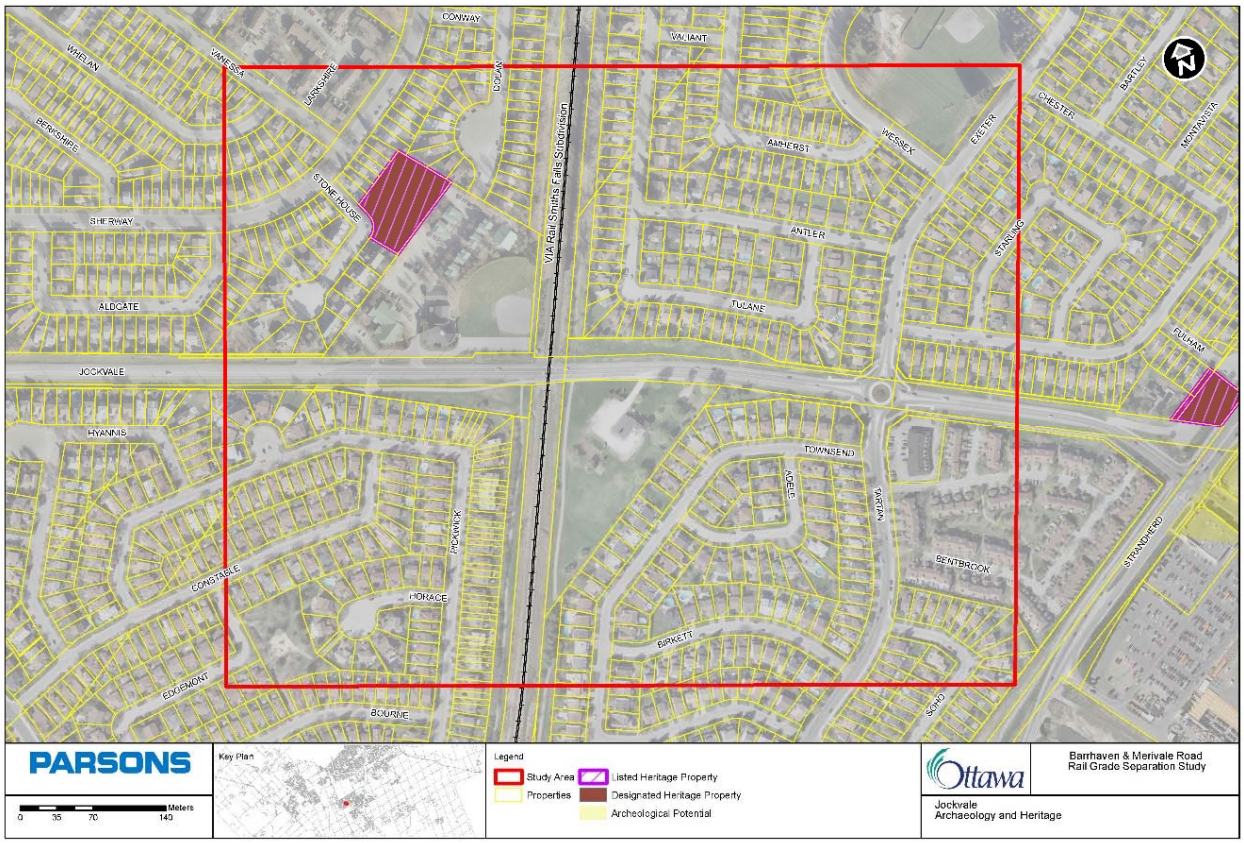
Figure 22: Land Ownership within the Jockvale Road Study Area



2.4.1.3 Archaeology and Heritage Resources

Figure 23 illustrates the location of one heritage property that is listed and designated within the study area however separated from the crossing by a sports park and residences. No areas of archaeological potential are identified within the study area.

Figure 23: Archeological Potential Mapping and Heritage Properties within the Jockvale Road Study Area



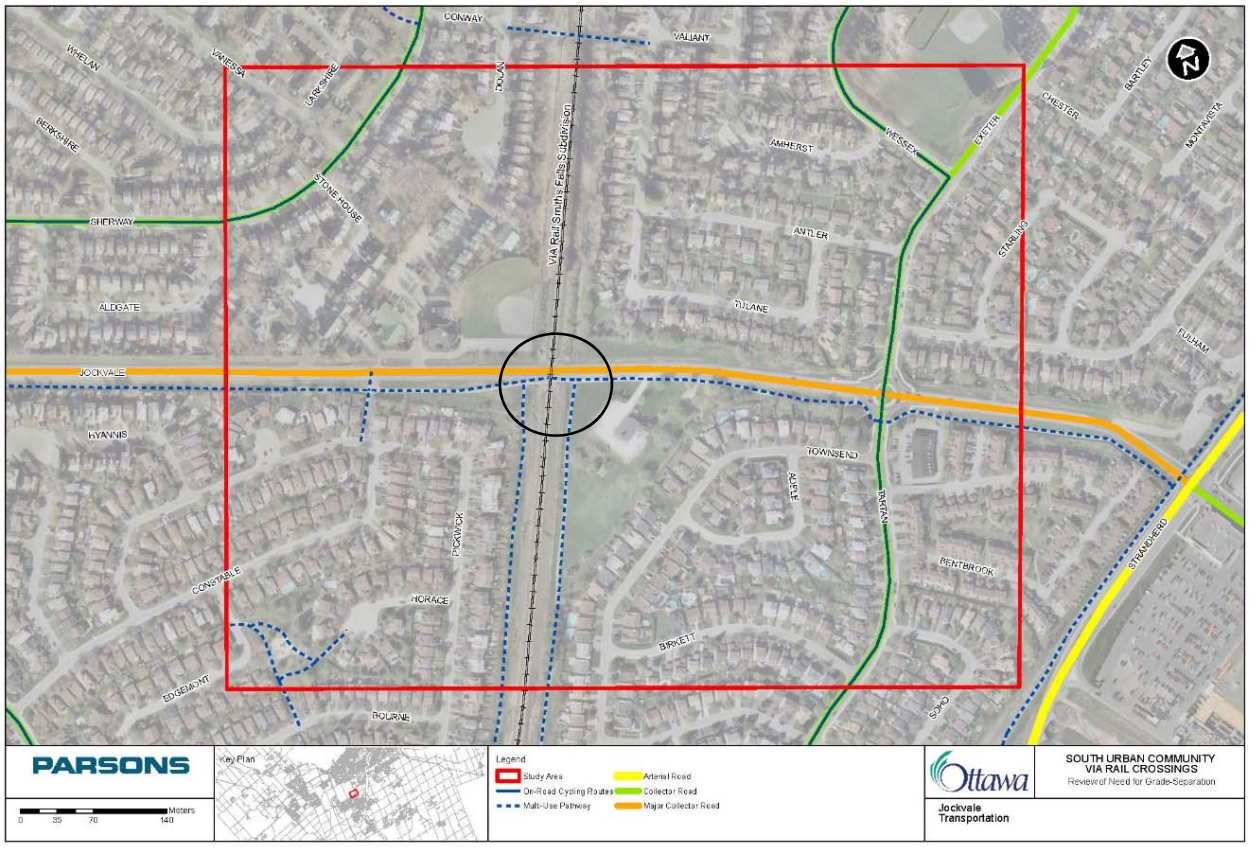
Note: Refer to Appendix G for full size diagram

2.4.2 PLANNING POLICIES

2.4.2.1 Transportation Master Plan, 2013

Transportation existing conditions are shown on **Figure 24** as designated in the City of Ottawa Official Plan (2013) and Transportation Master Plan (2013).

Figure 24: Transportation Network within the Jockvale Road Study Area



Note: Refer to Appendix G for full size diagram

Jockvale Road is a designated major collector road within the study area. The TMP (City of Ottawa, 2013) does not identify any future projects for Jockvale Road within the study area within the 2031 planning horizon.

Jockvale Road has bus stops located on both sides of the road providing local service.

2.4.2.2 Cycling and Pedestrian Plans, 2013

Presently, Jockvale Road does not have sidewalks. There are discontinuous sections of sidewalks on nearby neighbourhood roads, such as Weybridge, Fable, Sherway, Exeter and Tartan.

The City of Ottawa's Pedestrian Plan (City of Ottawa, 2013) identifies the construction of a new multi-use pathway parallel to the VIA Rail tracks, on the southeast side from Jockvale Road to Greenbank Road to fill in missing links to the network. Part of the multi-use pathway is now constructed from Greenbank Road to a point mid-way to Jockvale Road.

A multi-use pathway located on the southwest side of Jockvale Road is the only existing cycling facility provided within the study area.

The City's Cycling Plan (City of Ottawa, 2013) identifies the addition of two Phase 2 cycling projects within the study area for construction between 2020-2025. The one project is the previously mentioned multi-use pathway (partly planned for construction as a phase 1 project 2014-2019). The second is a neighbourhood bikeway provided as a shared use lane along Kennevale Drive. The ultimate cycling network and TMP (City of Ottawa, 2013) identifies Jockvale Road within the study area as a local route. A local route designation is associated with providing connections at the neighbourhood level provided as on-road facilities or painted bike lanes/shared lanes with mixed traffic.

2.4.2.3 Ottawa Official Plan (2013, as amended)

The OP provides a vision of the future growth for the City of Ottawa as well as a policy framework to guide its development to the planning year 2031. The OP serves as a basis for, and provides guidance on, a wide range of municipal activities. It is a legal document that addresses matters of provincial interest defined by the Provincial Policy Statement (PPS). The study area for the Jockvale Road crossing is within the urban policy area as shown on schedule B of the OP.

The Jockvale Road study area includes the following designation:

- General urban area

2.4.3 NATURAL ENVIRONMENT

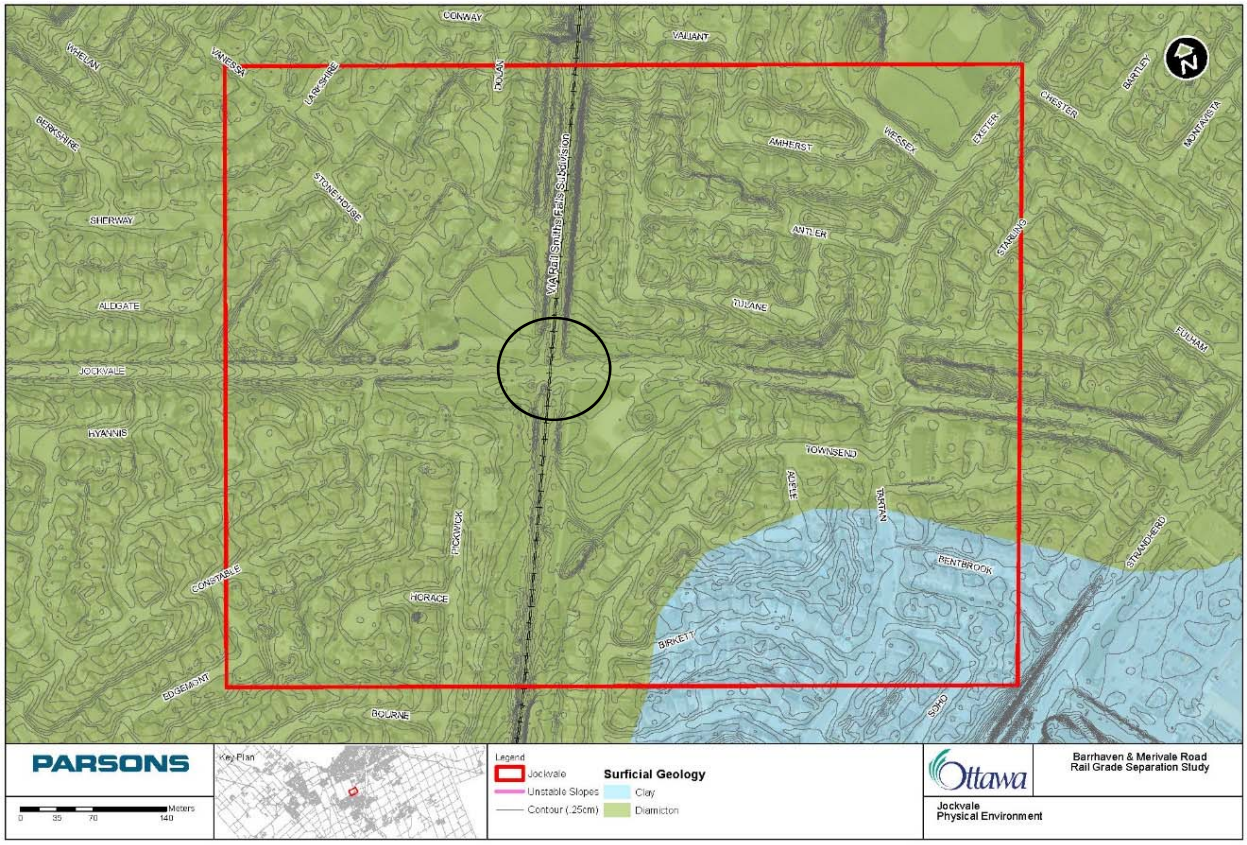
There are no natural heritage features within the Jockvale Road study area.

2.4.4 PHYSICAL ENVIRONMENT

Surficial geology within the study area is nearly all diamicton (a type of poorly sorted sedimentary deposit with particles ranging in size from clay to boulders suspended in a matrix of mud or sand) with some clay in the southeast portion of the study area (**Figure 25**).

Topography within the study area is generally flat (**Figure 25**).

Figure 25: Physical Environment Features within the Jockvale Road Study Area



Note: Refer to Appendix G for full size diagram

3.0 EXISTING AND FUTURE CONDITIONS ANALYSES – TRANSPORTATION

3.1 PRESENT ROADWAY AND CROSSING INFORMATION

3.1.1 MERIVALE ROAD

Merivale Road travels north/south in the western part of Ottawa between Island Park Drive just north of Highway 417 and continuous south until it is ends at Prince of Wales Drive along the Rideau River. The Road is classified as an urban arterial road. This subject section of the roadway is a two lane road with left turn lanes at MacFarlane Road and Slack Road and a sidewalk on the west side. The posted speed within the vicinity of the crossing is 50 km/h and the operating speed is 59 km/h. The roadway approaches have a grade of about 1%. In 2013 the vehicle traffic on Merivale Road was recorded to be an average of 15,534 vpd (AADT).

At the Merivale at-grade rail crossing, VIA Rail has one mainline set of tracks. The main track traverses the level grade crossing at Merivale Road at an angle of 128 degrees. Gate arms and cantilevered flashing light are located at the rail crossing. The crossing is located at approximate 108 m north of MacFarlane Road intersection and at about 225 m south of Slack Road intersection. The maximum permitted rail speed is 97 km/h (60 mph) and the average number of daily trains is 26 (25 passengers and 1 freight).

Figure 26 through **Figure 29** illustrate the existing conditions within the vicinity of Merivale Road Crossing.

Figure 26: Existing Merivale Road Crossing

Figure 27: Land use within the vicinity of the Crossing

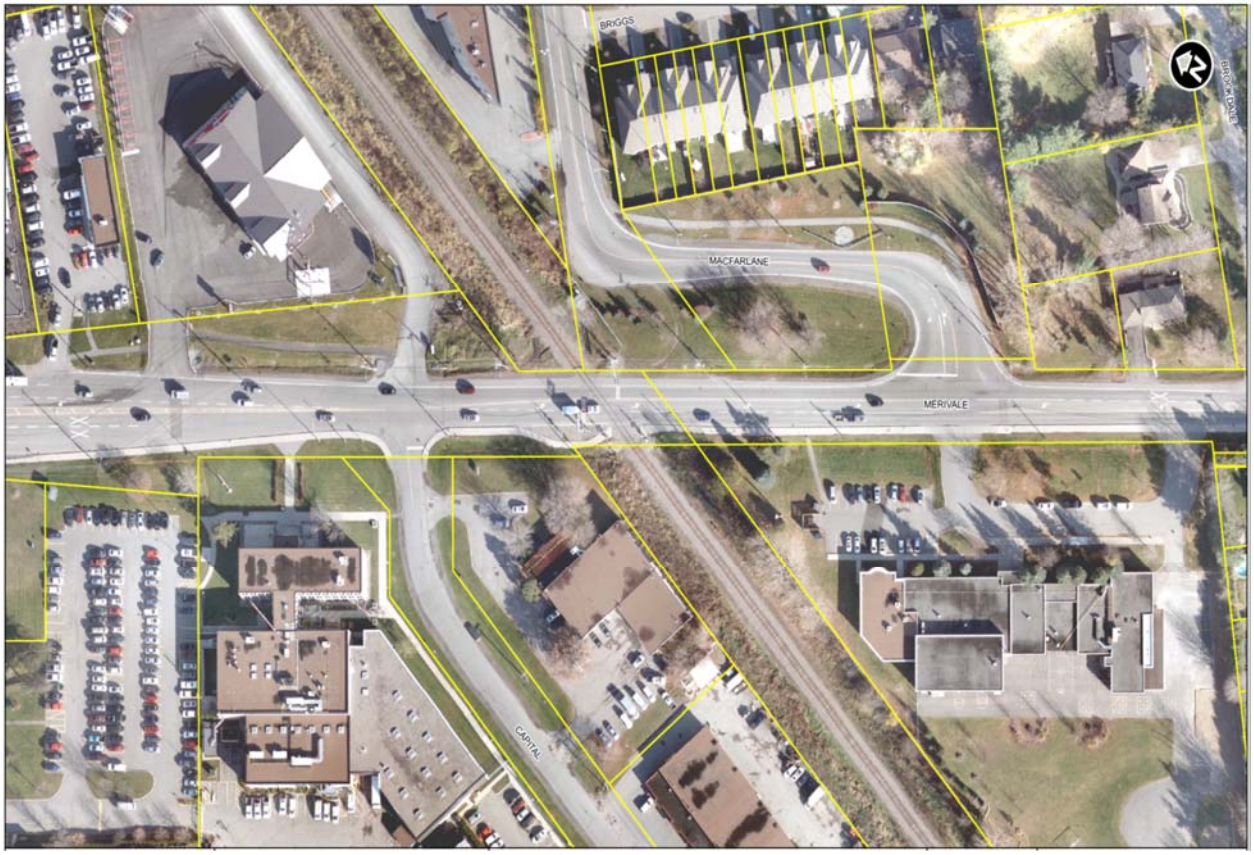


Figure 28: Merivale Road – View Looking South

Figure 29: Merivale Road – View Looking North

Roadway and crossing information for Merivale Road within the vicinity of the crossing are summarized in **Table 4** below.

Table 4: Merivale Road - Present Roadway and Crossing Information Summary Table

Merivale Road - Present Roadway and Crossing Information Summary Table	
Classification	Urban Arterial Undivided
AADT – 2013 count	15534
Posted Speed	50 km/hr
Operating Speed	59 km/hr
Number of Lanes	3
Sidewalks/Shoulders	2m – west side
General Grade	North Approach 1.0% - South Approach 0.9%
Nearby Intersections	MacFarlane Road & Slack Road
Cycling	Yes
Transit	Yes
Land use	Residential and commercial
Nearby Institution	St. Monica School
Trucks	Truck route
Roadway Surface Crossing Width	10.6 m
Angle between crossing and the roadway	128^{o}
Number of Tracks	1
Daily Train Volume	26 (25 passenger and 1 freight)
Maximum Rail Operating Speed	97 km/hr. (60 mph)
Train Design	B – Train Double – Length 25m
Collision History – 5 years period	1 (refer to section 3.2 for details)

3.1.2 WOODROFFE AVENUE AND SOUTHWEST TRANSITWAY

Woodroffe Avenue travels north/south in the western part of Ottawa. It runs south from Sir John A. Macdonald Parkway through Baseline Road to Strandherd Drive towards the communities of Manotick and Barrhaven. The road is classified as urban arterial road. At the rail crossing Woodroffe Avenue is a divided four lane road with a raised median and has a multi-use pathway (MUP) on the east side. Within the vicinity of the crossing, Greenbelt Pathway runs parallel to Woodroffe Avenue on the east side and Southwest Transitway runs parallel to Woodroffe Avenue on the west side. Woodroffe Avenue and Transitway are separated by vegetated island. The posted speed limit is 80 km/hr. and the operating speed is 94 km/hr. The north approach has a grade of 0.8% and the south approach has a grade of 0.2%. In 2013 the vehicle traffic on Woodroffe was recorded to be an average of 28,853 vpd (AADT).

A 3.0m wide MUP runs parallel to Woodroffe Avenue on the east side. Crossing lights and cross bucks protect the pathway and are visible to pedestrians. Barriers have been installed on each side of the pedestrian crossing to slow pedestrians and cyclists, as there are no gates protecting it.

The Transitway is a private two lane roadway for the exclusive use of City vehicles. In 2013, the Transitway averaged 1007 buses per weekday. From the OC Transpo Fallowfield Station, the Transitway extends for 248m eastward toward Woodroffe Avenue. From that point, the Transitway transitions into a significant left-hand sharp curve that turns sharply northward where it turns parallel to Woodroffe Avenue.

At the Woodroffe Avenue at-grade crossing, VIA Rail has one mainline track. The track traverses the level crossing at an angle of 130 degrees. The crossing is located at approximate 540m north of Fallowfield Road and at 890m south of Grenfell Crescent. The maximum permitted rail speed is 97 km/h (60 mph) . and the average number of daily trains is 26 (25 passengers and 1 freight).

Figure 30 through **Figure 33** illustrate the existing conditions within the vicinity of Woodroffe and Transitway Road Crossing.

Figure 30: Land use within the vicinity of the crossing

Figure 31: Woodroffe and Transitway Crossing

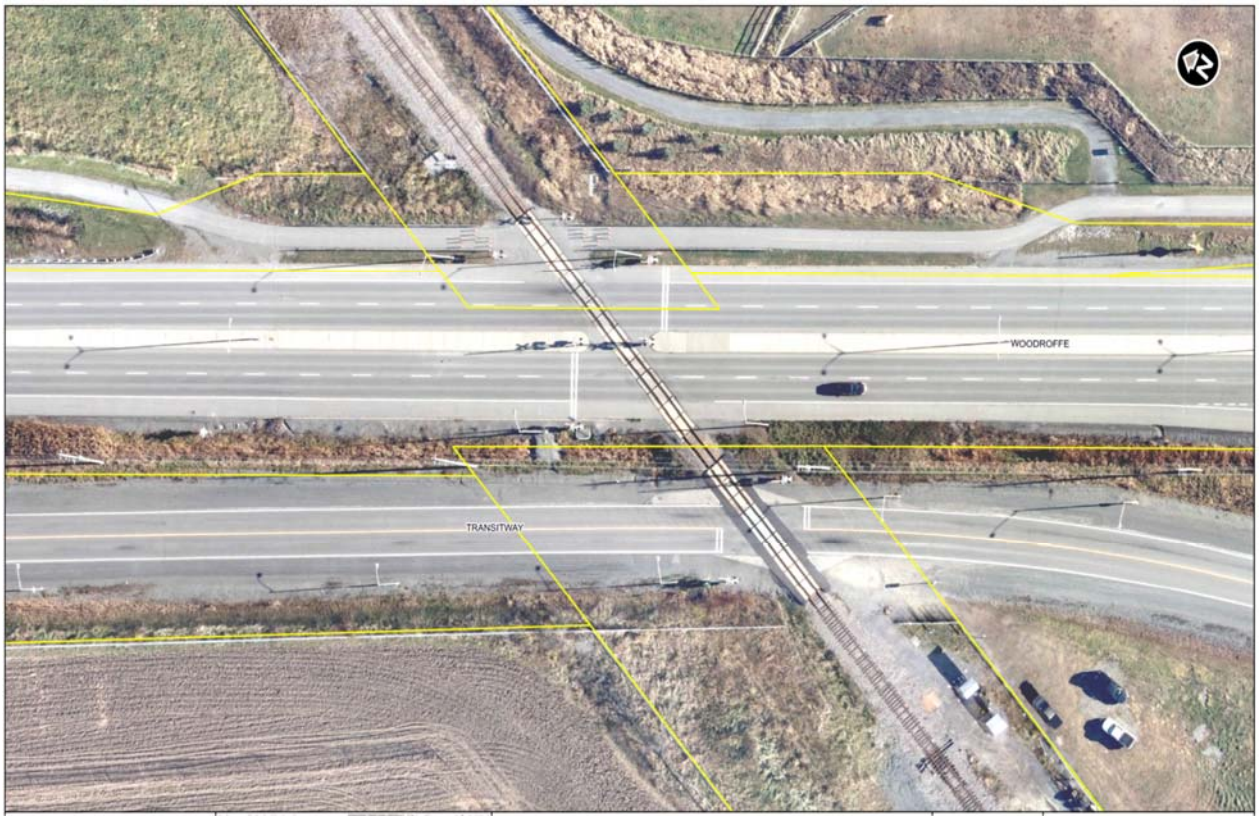


Figure 32: Street View Looking South

Figure 33: Street View Looking North

Roadway and crossing information for Woodroffe Avenue within the vicinity of the crossing are summarized in **Table** 5 below.

Table 5: Woodroffe Avenue – Present Roadway and Crossing Information

Present Roadway and Crossing Information	Woodroffe Avenue	Southwest Transitway
Classification	Urban Arterial Divided	Not applicable
AADT -2013 count	28,853 (Woodroffe Avenue)	1007 (Transitway)
Posted Speed	80 km/hr.	50 km/hr
Operating Speed	94 km/hr.	49 km/hr to 57 km/hr
Number of Lanes	4	2
Sidewalks/Shoulders	3.0 m on the east side	None / 1 m either side
General Grade	North Approach 0.8% - South Approach 0.2%	
Nearby Intersections	Fallowfield Road and Grenfell Crescent	Fallowfield Road
Cycling	Yes	No
Transit	No	Yes
Land use	Residential, Commercial , Agricultural, NCC	Residential, Commercial , Agricultural, NCC
Nearby Institution	None	None
Trucks	Truck Route	Not applicable
Roadway Surface Crossing Width	22.5 m	9.0m
Angle between crossing and the roadway	130°	130°
Number of Tracks	1	1
Daily Train Volume	26 (25 passenger and 1 freight)	26 (25 passenger and 1 freight)

Present Roadway and Crossing Information	Woodroffe Avenue	Southwest Transitway
Maximum Rail Operating Speed	97 km/h (60 mph)	97 km/h (60 mph)
Train Design	B – Train Double – Length 25m	B – Train Double – Length 25m
Collision History – 5 years period	4 (refer to section 3.2 for details)	1 (refer to section 3.2 for details)

3.1.3 FALLOWFIELD ROAD

Fallowfield Road travels east/west in the western part of Ottawa. It runs west from Prince of Wales Drive in Rideau to Dwyer Hill Road. The road is classified as an arterial road. At the rail crossing Fallowfield Road is a divided four lane road with a raised median. The posted speed limit is 80 km/h and the operating speed is 84 km/h. The north approach has a grade of 0.5% and the south approach has a grade of 0.1%. In 2015 the vehicle traffic on Fallowfield was recorded to be an average of 28,890 vpd (AADT).

A 3.0m wide MUP is located on the south side of Fallowfield Road. The MUP crossing is equipped with flashing lights, gates and a bell. The approaches to the pathway crossing are fenced to deter people from going around the gates. Gaps between the gates and the fence ensure proper clearance to the ROW, but do allow pathway users to bypass the gates.

At the Fallowfield Road at-grade crossing, VIA Rail has one mainline track and one siding track to the north of the crossing. The tracks traverse the level crossing at an angle of 33 degrees. VIA Park Place intersection is located at approximately 490m east of the crossing and Holitman Drive intersection is located at approximate 780m west of the crossing. The maximum permitted rail speed is 97 km/h (60 mph) and the average number of daily trains is 19 (18 passengers and 1 freight).

The Fallowfield Rd grade crossing's proximity to and interconnection with the adjacent Southwest Transitway & Fallowfield Rd signalized intersection contributes to a complex road environment for drivers on Fallowfield Rd approaching the crossing/intersection. Of particular and ongoing concern for the City of Ottawa, VIA Rail and Transport Canada is the extent to which this complexity may be contributing to vehicle/gate interaction and undesirable driver behavior at the crossing. To address these concerns prior to grade separation, the City of Ottawa is actively pursuing strategies and mitigation measures to eliminate vehicle/gate interactions and undesirable driver behavior at the crossing. Existing conditions within the vicinity of Fallowfield Road Crossing are illustrated in the following four images.

Figure 34: Land use within vicinity of the crossing

Figure 35: Fallowfield Road Crossing

Figure 36: Street View Looking West

Figure 37: Street View Looking East

Roadway and crossing information for Fallowfield Road within the vicinity of the crossing are summarized in **Table** 6 below.

Table 6: Fallowfield Road - Present Roadway and Crossing Information - Summary Table

Fallowfield Road - Present Roadway and Crossing Information - Summary Table	
Classification	Urban Arterial Divided
AADT -2015 count	28,890
Posted Speed	80 km/hr.
Operating Speed	84 km/hr.
Number of Lanes	4
Sidewalks/Shoulders	3.0 m on the south side
General Grade	North Approach 0.5% , South Approach 0.1%
Nearby Intersections	Via Park Place and Holitman Drive. Crossing is tied into the intersection of Fallowfield and SW Transitway.
Cycling	Yes
Transit	Yes
Land use	Residential, Commercial, Agriculture, NCC
Nearby Institution	None
Trucks	Truck Route
Road Surface Crossing Width	21.1m
Angle between crossing and the roadway	33^{o}
Number of Tracks	1
Daily Train Volume	19 (18 passenger and 1 freight)
Maximum Rail Operating Speed	97 km/h (60 mph)
Train Design / Length	B – Train Doubles / 25 m
Collision History – 5 years period	5 (refer to section 3.2 for details)

3.1.4 JOCKVALE ROAD

Jockvale Road previously provided a north-south connection between Cedarview Road and Prince of Wales Drive but is now truncated with sections existing north of Strandherd Road and south of Greenbank Road. The northern section is classified as a Major Collector. At the rail crossing it is an undivided two lane road with 2.3m MUP on the west side of the street. The posted speed within the vicinity of the track is 60 km/h and the operating speed is 69 km/h. The north approach has a grade of -1.00% and the south approach has a grade of 0.1%. In 2015 the vehicle traffic on Jockvale Road was recorded to be an average of 11,581 vpd (AADT).

At the Jockvale Road at-grade crossing, VIA Rail has one mainline track. The track traverses the level crossing at an angle of 86 degrees. Tartan Drive/Exeter Drive roundabout is located approximately 323m south of the crossing and Weybridge Drive/Fable Drive roundabout is located at approximately 575m north of the crossing. The maximum permitted rail speed is 97 km/h (60 mph) and the average number of daily trains is 19 (18 passengers and 1 freight). Existing conditions within the vicinity of Jockvale Road Crossing are shown in **Figure 38** to **Figure 41** below.

Figure 38: Land use within the vicinity of the crossing

Figure 39: Jockvale Road Crossing

Figure 40: Street View Looking Southeast

Figure 41: Street View Looking Northwest

Roadway and crossing information for Jockvale Road within the vicinity of the crossing are summarized in **Table 7** below.

Table 7: Jockvale Road Present Roadway and Crossing Information Summary Table

Jockvale Road Present Roadway and Crossing Information Summary Table	
Classification	Major Collector
AADT – 2015 count	11,581
Posted Speed	60 km/hr.
Operating Speed	69 km/hr.
Number of Lanes	2
Sidewalks/Shoulders	2.3m on the west side
General Grade	North Approach 1.0% , South Approach 0.1%

Jockvale Road Present Roadway and Crossing Information Summary Table	
Nearby Intersections	Tartan Drive/Exter Drive Roundabout and Weybridge Drive/Fable Drive Roundabout
Cycling	Yes
Transit	Yes
Land use	Residential
Nearby Institution	Barrhaven United Church and Barrhaven Fellowship Christian Reform church
Trucks	Truck Route
Angle between crossing and the roadway	86°
Number of Tracks	1
Daily Train Volume	19 (18 passenger and 1 freight)
Maximum Rail Operating Speed	97km/h (60 mph)
Collision History – 5 years period	None

3.2 HIGHWAY-RAIL AT GRADE CROSSING COLLISION HISTORY

Highway – Rail at grade crossing collision history were compiled from previous studies for the period from 2009 – 2013 (5 year period). The following table summarizes the history of accident that occurred at each of the study location.

Table 8: Highway Rail at Grade Crossing Collision History

Highway-Rail at Grade Crossing Collision History				
Crossing Name	**VIA Crossing Location – Mile #**	**Number of Accidents Occurring (5 year period)**	**Type of Accident**	**Severity of Accident**
Merivale Road	1.63	1	Rear end collision.	No pedestrians, cyclists or train involved. Property damage only.
Woodroffe Avenue	3.28	4	Two single motor vehicle collisions, one rear end collision and one side swipe collision.	No pedestrians, cyclists or train involved. Property damage only for all four collisions.
Southwest Transitway	3.3	1	One angle collision involving a train and a municipal transit bus.	No pedestrians, cyclists involved. 6 fatalities and 9 serious injuries, and about 25 minor injuries were reported.
Fallowfield Road	3.88	5	Two rear end collisions, three single motor vehicle collisions.	No pedestrians, cyclists or train involved. Property damage only for all five collisions.
Jockvale Road	5.73	0	N/A.	N/A.

3.3 HISTORICAL TRAFFIC DATA AND NUMBER OF TRAINS

3.3.1 MERIVALE ROAD

Historical traffic count data for Merivale Road, in the vicinity of the VIA Rail crossing, were compiled from previous studies. The data are summarized in **Table 9** below for both road and rail traffic.

Table 9: Merivale Road Traffic and Train Data

Merivale Road Traffic and Train Data		
Year Count	**AADT**	**Number of Trains**
2004	-	10
2007	-	15
2008	11,030	-
2010	-	15
2013	15,534	-
2014	-	25
Source: VIA Rail Canada and the City of Ottawa – Detailed Safety Assessment Report Railway Investigation Report R13T0192 – Crossing Collision		

3.3.2 WOODROFFE AVENUE AND TRANSITWAY

Historical traffic count data for Woodroffe Avenue and the Southeast Transitway, in the vicinity of the VIA Rail crossing, were compiled from previous studies. The data are summarized in **Table 10** below for both road and rail traffic.

Table 10: Woodroffe Avenue and Transitway Traffic and Train Data

Woodroffe Avenue and Transitway Traffic and Train Data		
Year Count	**AADT**	**Number of Trains**
Woodroffe Avenue		
2004	18,163	10
2007	22,335	15
2010	25,154	15
2013	28,853	-
2014	-	25
Transitway		
2007	-	15
2010	390	10
2013	1,007	-
2014	-	25
Source: VIA Rail Canada and the City of Ottawa – Detailed Safety Assessment Report Railway Investigation Report R13T0192 – Crossing Collision		

3.3.3 FALLOWFIELD ROAD

Historical traffic count data for Fallowfield Road, in the vicinity of the VIA Rail crossing, were compiled from previous studies. The data are summarized in **Table 11** below for both road and rail traffic.

Table 11: Fallowfield Road Traffic and Train Data

Fallowfield Road Traffic and Train Data		
Year Count	AADT	Number of Trains
2004	-	10
2007	-	10
2010	19,387	10
2012	22,582	-
2014	18,541	18
2015	28,890	-
Source: VIA Rail Canada and the City of Ottawa – Detailed Safety Assessment Report Railway Investigation Report R13T0192 – Crossing Collision		

3.3.4 JOCKVALE ROAD

Historical traffic count data for Jockvale Road, in the vicinity of the VIA Rail crossing, were compiled from previous studies. The data are summarized in **Table 12** below for both road and rail traffic.

Table 12: Jockvale Road Traffic and Train Data

Jockvale Road Traffic and Train Data		
Count Year	AADT	Number of Trains
2004	-	10
2005	6,926	-
2007	-	10
2010	-	10
2014	9,368	18
2015	11,581	-
Source: VIA Rail Canada and the City of Ottawa – Detailed Safety Assessment Report Railway Investigation Report R13T0192 – Crossing Collision		

3.4 FORECASTED NUMBER OF TRAINS

The forecasted number of trains for 2016, 2021 and 2031 at each of the five crossing locations were derived based on input from VIA Rail. Both the historical and forecasted data are summarized in **Table 13** (passenger) and **Table 14** (freight). It was confirmed by VIA staff that the projected numbers account for potential deadheading train movements for beginning and end of day service to/from the Fallowfield Station. This relates to train sets crossing over the Transitway and Woodroffe Avenue crossing location to migrate back to the Ottawa Station to be stored overnight or continue the route to Montreal.

Table 13: Variation of Passenger Train Volume

Passenger Train Volume									
Crossing	**2004**	**2007**	**2010**	**2014**	**2016**	**2021**	**2021 HFR**	**2031**	**2031 HFR**
Merivale	10	14	14	23	25	32	38	32	48
Woodroffe	10	14	14	23	25	32	38	32	48
Transitway	-	14	14	23	25	32	38	32	48
Fallowfield	10	10	10	16	18	20	30	20	36
Jockvale	10	10	10	16	18	20	30	20	36
	Source: Historical - VIA Rail Canada and the City of Ottawa – Detailed Safety Assessment Report *Source: Projected 2016 to 2031 – as provided by VIA Rail Network Planning Group on March 7, 2017.*								

HFR = High Frequency Rail project which is currently being looked into by VIA and federal agencies although at this time it has not been approved.

Table 14: Variation of Freight Train Volume

Freight Train Volume							
Crossing	**2004**	**2007**	**2010**	**2014**	**2016**	**2021**	**2031**
Merivale	1	1	1	1	1	1	1
Woodroffe	1	1	1	1	1	1	1
Transitway	1	1	1	1	1	1	1
Fallowfield	1	1	1	1	1	1	1
Jockvale	1	1	1	1	1	1	1

3.5 FORECASTED AADT FOR 2016, 2021 AND 2031

To forecast future AADT values for the horizon years of 2016, 2021, and 2031, two different approaches were used. The first approach is based on the historical traffic volumes to obtain an average annual growth rate, which was subsequently applied to a current count to forecast future AADT. This is considered a very simplistic approach, and can lead to excessively high projections as aggressive growth rates are typically not sustainable over longer-term planning horizons. As a comparison, a standard annual growth rate of 2% per annum, which is considered consistent with normal regional growth trends, was also applied.

In those cases where the surrounding community is mature and well-established, annual growth on a particular road segment may in fact be negligible, or even exhibit a negative growth trend. Jockvale Road through Barrhaven West – Old Barrhaven is one example of a major collector road that is unlikely to experience significant growth in traffic volumes.

3.5.1.1 Method 1: Historical Annual Growth Rate

The following computational steps were followed to forecast future AADT based on historical traffic counts. Note that where data were available, more than two counts should be considered in estimating the historical growth rate.

Step 1: Estimate an average growth rate (*Gr*) using available historical data:

$$AADT\ Yr2 = AADT\ Yr1\ (1 + Gr)^{\,Yr2-Yr1}$$

Gr = growth rate between Year 1 and Year 2
Yr2 = second year for which AADT was available, and
Yr1 = first year for which AADT was available

Step 2: Estimate the AADT for future years:

$$AADT\ Fyr = AADT\ Byr\ (1 + Gr)^{\,Fyr-Byr}$$

Fyr = future year
Byr = base year
Gr = average annual growth rate

A second approach used the TRANS Regional Model to forecast future AADT. The TRANS model is a regional travel demand forecasting tool used by the City of Ottawa to assess the impact various policy, growth and land use assumptions, as well as investments in transportation infrastructure, including transit and roadway networks. Note that the TRANS model is calibrated to the AM peak hour only, and therefore expansion factors are needed to estimate AADT values from peak directional volume forecasts on individual road segments. It is also important to recognize that the model encompasses the entire National Capital Region, and is calibrated at a screenline level. Therefore, using volume forecasts for individual road segments must be done with caution.

The City of Ottawa has developed two different models. Phase 1 model was the version essentially used to prepare the 2013 Transportation Master Plan (TMP), whereas Phase 2 model is a more refined version that addresses some issues regarding transit assignment. Note that both models include, as of May 2016, an updated 2031 land use projection. Using both models, average and maximum annual growth rates were used to compute projected two-way peak hour traffic volumes crossing the VIA rail line.

As recommended by the City of Ottawa, in order to convert projected peak hour traffic volumes to AADT, a conversion factor in the range of 11 to 12.5 is considered appropriate. This range was obtained primarily from two sources: local traffic counts and 2011 OD Survey.

3.5.1.2 Method 2: TRANS Model – Phase 1 & 2

The following computational steps were followed to forecast future AADT based on the results of the TRANS regional model

Step 1: Estimate an average growth rate (*Gr*) using simulated TRANS model volumes for individual road links (directional):

$$Peak\ hour\ volume\ Yr2031 = Peak\ hour\ volume\ Yr2011\ (1 + Gr)^{\,20}$$

Gr = growth rate between Year 2031 and Year 2011

Step 2: Apply directional average growth rate (*Gr*) to most recent ground count to forecast directional link volume.

$$Peak\ hour\ volume\ Fyr = Peak\ hour\ volume\ Byr\ (1 + Gr)^{\,Fyr-Byr}$$

Fyr = future year

Byr = base year
Gr = average annual growth rate

Step 3: Sum forecasted directional link volumes to obtain two-way link volumes.

Step 4: Apply expansion factor (12.5) to convert projected two-way peak hour volumes to AADT.

Table 15 through **Table 18** summarize the results of the foregoing analytical steps at each location at year 2016, 2021, and 2031. The row highlighted in green represents the recommended AADT forecast to be used based on a combination of factors, including: knowledge of local area; professional judgment; and sensitivity to the ensuing cross-product calculation (see Section 3.5).

Table 15: Merivale Road - Estimated AADT 2016, 2021 and 2031

Merivale Road - Estimated AADT 2016,2021 and 2031						
Method	**2008**	**2013**	**Growth Rate**	**2016**	**2021**	**2031**
Historical – Actual	11,030	15,534	7.1%(1)	19,083	26,891	53,394
Historical – Capped (2.0%)	-	-	2.0%	16,458	18,201	22,186
TRANS Model(2)	-	-	-0.8 to 0.1%	17,040	16,869	16,554
Note: 1) Growth rate based on two historical counts: 2008 and 2013 2) TRANS model outputs a growth rate per direction						

The recommended growth rate for Merivale Road at the crossing is 2.0% per annum. The actual historical growth rate of 7.1% is considered too high to be sustained over a long period of time, whereas the TRANS model is forecasting a slight reduction in traffic volumes over the next 15 years. Despite the large variance, all three methods result in AADT forecasts at 2031 that satisfy the Cross Product requirement (see Section 3.5).

Table 16: Woodroffe Ave and Transitway - Estimated AADT 2016, 2021 and 2031

Woodroffe Ave and Transitway - Estimated AADT 2016,2021 and 2031						
Method	**2010**	**2013**	**Growth Rate**	**2016**	**2021**	**2031**
Woodroffe Ave						
Historical – Actual	25,154	28,853	5.1%(1)	33,496	42,955	70,638
Historical – Capped (2.0%)	-	-	2.0%	30,619	33,806	41,209
TRANS Model(2)	-	-	-0.2 to 1.6%	22,401	22,549	22,848
Southwest Transitway						
Historical(4)	390	1,007	4.5%(3)	1,149	1,432	2,224
TRANS Model(4)	-	-	4.1%(5)	1,136	1,389	2,076
Note: 1) Growth rate based on four historical counts: 2004, 2007, 2010, & 2013 2) TRANS model outputs a growth rate per direction 3) Volume counts obtained from *Railway Investigation Report R13T0192 – Crossing Collision* 4) Transportation Safety Board (TSB) conducted a vehicle count survey between September and October 2013 5) Growth rate for Transitway TRANS model calculated based on AM scenario 2011 model V2.2 and 2031						

The recommended growth rate for Woodroffe Avenue at the crossing is 2.0% per annum. The actual historical growth rate of 5.1% is considered too high to be sustained over a long period of time, whereas the TRANS model is forecasting a negligible increase in traffic volumes over the next 15 years. Despite the large variance, all three methods result in AADT forecasts at 2031 that satisfy the Cross Product requirement (see Section 3.5).

The recommended growth rate for Southwest Transitway at the crossing is 4.1% per annum. The actual historical growth rate of 4.5% is considered too high to be sustained over a long period of time, whereas the TRANS model is forecasting an increase in traffic volumes over the next 15 years. Despite the large variance, all three methods result in AADT forecasts at 2031 that satisfy the Cross Product requirement (see Section 3.5).

Table 17: Fallowfield Road Estimated AADT 2016, 2021 and 2031

Fallowfield Road Estimated AADT 2016,2021 and 2031						
Method	2012	2015	Growth Rate	2016	2021	2031
Historical - Actual	22,582	28,890	6.8%(1)	30,855	42,872	82,773
Historical – Capped (2.0%)	-	-	2.0%	29,468	32,535	39,660
TRANS Model(2)	-	-	0 to 0.9%	29,074	29,840	31,480
Note: 1) Growth rate based on three historical counts: 2012, 2014, & 2015 2) TRANS model outputs a growth rate per direction						

The recommended growth rate for Fallowfield Road at the crossing is 2.0% per annum. The actual historical growth rate of 5.7% is considered too high to be sustained over a long period of time, whereas the TRANS model is forecasting a slight increase in traffic volumes over the next 15 years. Despite the large variance, all three methods result in AADT forecasts at 2031 that satisfy the Cross Product requirement (see Section 3.5).

Table 18: Jockvale Road Estimated AADT 2016, 2021 and 2031

Jockvale Road Estimated AADT 2016,2021 and 2031						
Method	2014	2015	Growth Rate	2016	2021	2031
Historical – Actual	9,368	11,581	4.6%(1)	12,114	15,168	23,782
Historical – Capped (2.0%)	-	-	2.0%	11,452	12,643	15,412
Historical – Capped (0.5%)	-	-	0.5%	11,283	11,568	12,160
TRANS Model(2)	-	-	-0.4 to 1.0%	12,263	12,444	12,648
Note: 1) Growth rate based on three historical counts: 2005, 2014, & 2015 2) TRANS model outputs a growth rate per direction						

The recommended growth rate for Jockvale Road at the crossing is 2.0% per annum. However, on-going monitoring of traffic volumes at this location is recommended to confirm the actual growth rate in recent years. The actual historical growth rate of 4.6% is considered too high to be sustained over a long period of time, and intuitively the volumes on this road are expected to be stable given the area context. The TRANS model is forecasting a negligible increase in traffic volumes over the next 15 years. The analysis indicates that an annual growth rate of less than approximately 0.5% would result in the Cross Product requirement not being satisfied (see Section 3.5). **Table 19** summarizes the growth rates and projected AADT of the foregoing crossings.

Table 19: Estimated AADTs 2016, 2021 and 2031 for all crossings

Estimated AADT 2016,2021 and 2031				
Crossing	Suggested Growth Rate	2016	2021	2031
Merivale	2.0%	16,458	18,201	22,186
Woodroffe	2.0%	30,619	33,806	41,209
Southwest Transitway	4.1%	1,136	1,389	2,076
Fallowfield	2.0%	29,468	32,535	39,660
Jockvale	2.0%	11,452	12,643	15,412

3.6 RAIL/ROAD CROSSING EXPOSURE INDEX (CEI)

The Crossing Exposure Index (CEI) is the measure typically used to assess the merit of grade separating a road and rail. The index is obtained by multiplying the number of roadway vehicles by the number of trains that use a crossing during an average day. It is also, known as "Cross Product".

CEI was one criterion that was used to assist in prioritizing the funding of grade separation by Transport Canada (TC). A CEI of 200,000 was the accepted benchmark in order for a new grade separation project to be considered. However, no funding has been provided by TC pursuant to *Section 13 of the Railway Safety Act* since 1989, as per a government policy to not appropriate funds in this regard. The railway companies and road authorities apply for the planning of such installations as part of their road transportation network while the railway are involved in the detailed design of the structure to ensure safe railway operations.

While Transport Canada does regulate as to when a crossing at-grade is not permitted, there is no requirement outlining when a grade separation should be considered. In Canada, there are no regulations, standards or guidelines that identify when level crossing should be grade separated. Also, Transport Canada has no firm CEI value that requires a grade separation to be built. In comparison, the United States Department of Transportation (DOT) Federal Highway Administration (FHWA) *Railroad-Highway Crossing* Handbook (2007) provides specific guidance as to when grade separation should be considered. Chapter V, Section 6, Grade Separation, states the following:

A. Highway-rail grade crossing should be considered for grade separation or *otherwise eliminated across the railroad right-of-way whenever one or more of the following conditions exist:*

1. The posted highway speed equals or exceeds 100 km/hr.
2. AADT exceeds 100,000 in urban areas or 50,000 in rural areas.
3. Maximum authorized train speed exceeds 170 km/hr.
4. An average of 75 or more passenger trains per day in urban areas or 30 or more passenger trains per day in rural areas.
5. Crossing exposure (the product of number of trains per day and AADT) exceeds 1 million in urban areas or 250,000 in rural areas; or
6. Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 800,000 in urban areas or 200,000 in rural areas.

B. Highway-rail grade crossing should be considered for grade separation across the railroad right-of-way whenever the *cost of grade separation can be economically justified based on fully allocated life-cycle costs and one or more of the following conditions exist:*

1. The posted highway speed exceeds 90 km/hr.
2. AADT exceeds 50,000 in urban areas or 25,000 in rural areas.
3. Maximum authorized train speed exceeds 160 km/hr.
4. An average of 50 or more passenger trains per day in urban areas or 12 or more in rural areas.
5. Crossing exposure (the product of number of trains per day and AADT) exceeds 500,000 in urban areas or 125,000 in rural areas; or
6. Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 400,000 in urban areas or 100,000 in rural areas.

As noted in Section 1.3 earlier in this report, the Transportation Safety Board issued recommendation R15 – 04 which request TC to provide similar guidance to that contained in FHWA.

The estimated daily crossing exposures for the existing and future traffic conditions considering the total daily trains (passenger and freight trains) and considering only passenger trains are outlines in **Table 20** and in **Table 21** below. The rationale behind considering 2010 and 2014 was that Detailed Safety Assessment studies, which

were completed in 2010 and 2014, respectively. Note that when ground counts for 2010 or 2014 were unavailable, AADT values were estimated based on the recommended annual growth rate.

Table 20: Crossing Exposure Rate – AADT X Total No. of Trains

Estimated Crossing Exposure Rate – AADT X Total No. of Trains					
Crossing Name	Daily Crossing Exposure Rate				
	2010	2014	2016	2021	2031
Merivale Road	219,570(1)	380,280(2)	427,908	600,633	1,087,114
Woodroffe Avenue	377,310	632,881(2)	796,094	1,115,598	2,019,241
Fallowfield Road	238,756(1)	481,500(3)	559,892	618,165	1,467,420
Jockvale Road	95,200(1)	159,256	217,588	240,217	570,244

Note:
(1) No 2010 ground traffic count for this location, therefore 2010 AADT is based on back-casting the 2.0% annual growth rate
(2) No 2014 ground traffic count for this location, therefore 2014 AADT is based on the recommended 2.0% annual growth rate with 2010 AADT acting as a base year
(3) 2015 AADT used instead of 2014 since there was a sudden drop in the 2014 AADT on Fallowfield Road

The current and future exposure rates at Merivale, Woodroffe and Fallowfield are far greater than the threshold warrant of **200,000**. Also, considering the 2021 train and traffic volume cross-product values, the three crossings met the FHWA cross-product criteria for grade separation. In addition, the forecasted exposure rates at the Jockvale crossing are greater than the benchmark and as such meets the FHWA cross-product criteria for grade separation. However the difference between the exposure rate and benchmark value is not as large as the other three crossings.

Table 21: Crossing Exposure Rate – AADT X No. of Passenger Trains

Estimated Crossing Exposure Rate – AADT X No. of Passenger Trains					
Crossing Name	Daily Crossing Exposure Rate				
	2010	2014	2016	2021	2031
Merivale Road	204,932(1)	364,435(2)	411,450	582,432	1,064,928
Woodroffe Avenue	352,156	606,511(2)	765,475	1,081,792	1,978,032
Fallowfield Road	217,051(1)	453,176	530,424	585,630	1,427,760
Jockvale Road	86,546(1)	149,888	206,136	227,574	554,832

Note:
(1) No 2010 ground traffic count for this location, therefore 2010 AADT is based on back-casting the 2.0% annual growth rate
(2) No 2014 ground traffic count for this location, therefore 2014 AADT is based on the recommended 2.0% annual growth rate with 2010 AADT acting as a base year

Both the current and future exposure rates at Merivale, Woodroffe and Fallowfield are far greater than the threshold warrant of **200,000**. Also, considering the 2021 train and traffic volume cross-product values, the three crossings met the FHWA cross-product criteria for grade separation. In addition, the forecasted exposure rates at the Jockvale crossing are greater than the benchmark and as such meets the FHWA cross-product criteria for grade separation. However, the difference between the exposure rate and benchmark value is not as large as the other three crossings. It must be noted that the exposure rate value may be used as a preliminary assessment of the warrant for grade separation; however, the exposure rate alone should not be used as justification for grade separation.

3.7 SOUTHWEST TRANSITWAY CROSSING EXPOSURE INDEX (OCEI)

The occupant crossing exposure index (OCEI) is calculated by multiplying the total number of trains crossing per day multiplied by the AADT and then multiply by the average number of vehicle occupants/bus. The use of the OCEI calculation is not currently an industry standard and not commonly used. The recent TSB Report for the Southwest Transitway incident did include OCEI and as such it has been reviewed here for comparison purposes. It should be noted that the use of OCEI has several shortcomings such as it does not take into consideration the number of train passengers. **Table 22** outlines the estimated OCEI values for the years 2010, 2016, 2021 and 2031.

Table 22: Occupant Crossing Exposure Index – Transitway

Occupant Crossing Exposure Index – Transitway(2)					
Crossing Name	Daily Crossing Exposure Rate				
	2010	2013	2016	2021	2031
Transitway(1)	187,200	805,084	945,152	1,466,784	3,255,168
Note: 1) Average number of vehicle occupants per bus equaling 32 2) Total number of trains used to calculate crossing exposure rate at 2016, 2021, and 2031 are based on forecasted values obtained from VIA Rail					

3.8 RECOMMENDATION

Given the foregoing analyses, the need for grade separation at four of the locations is considered definitive today. The vehicle crossing component (i.e., AADT) of the Jockvale crossing may sustain negligible growth within the next 10 year period, and should there also be no increase in train activity, the estimated crossing exposure rate would be slightly below the threshold to consider grade separation. Longer term by 2031, VIA Rail is forecasting increased train activity in which case the need for grade separation at this location is also definitive.

3.9 UTILITIES AND MUNICIPAL SERVICES

3.9.1 MERIVALE ROAD

Watermains: A Municipal water supply network services many residences and businesses in the Study Area. A 406mm diameter watermain runs along Merivale Road and services the following:

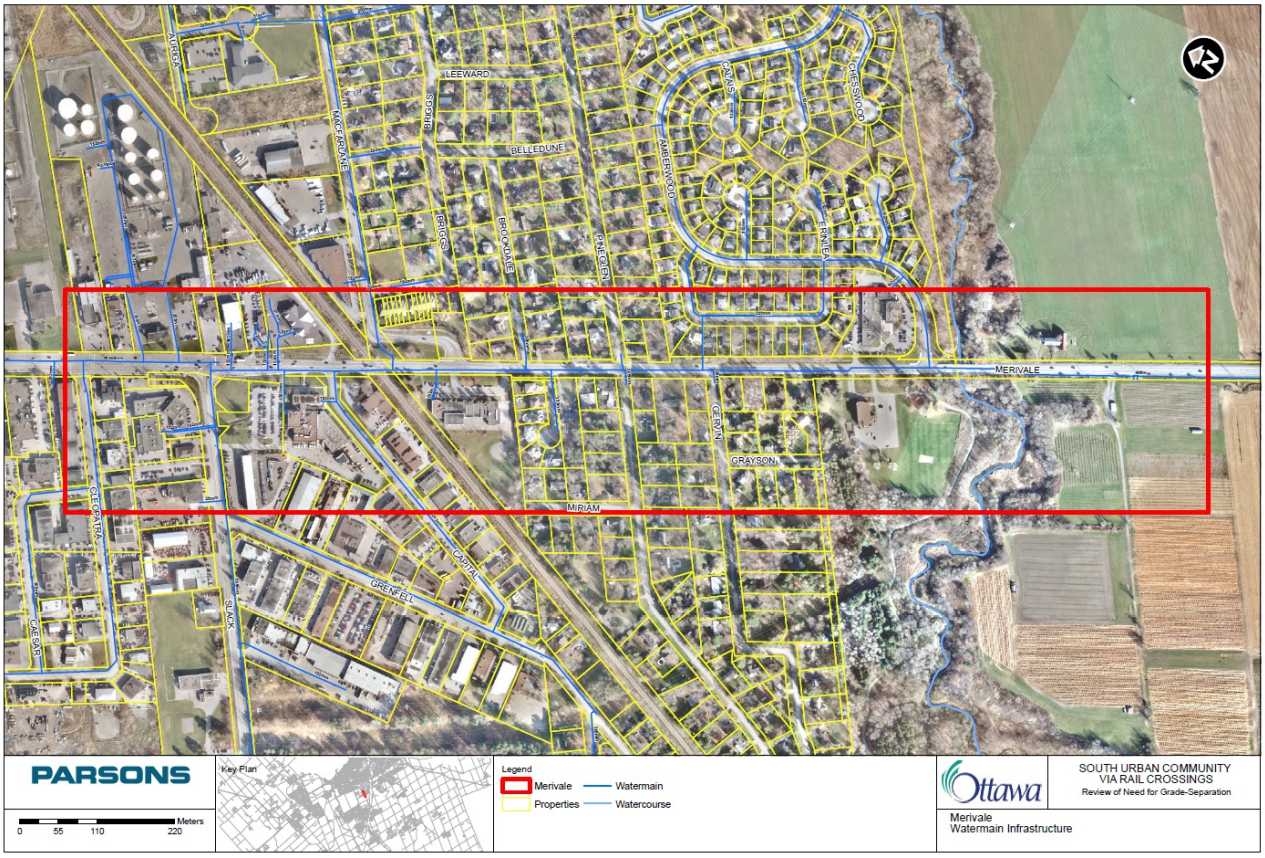
- Residences around the Amberwood and Weatherwood Crescents;
- Commercial and industrial areas along Capital Drive and Slack Drive;
- Businesses along Merivale Road such as Suds Car Wash, Enterprise and Mehdi Auto Service; and
- St. Monica School.

The 406mm diameter watermains, which run along Merivale Road and MacFarlane Road, are also considered to be backbone infrastructure. Backbone infrastructure is the bulk delivery system that distributes water to pumping stations and/or reservoirs to meet system demand objectives.

There are a few watermains that cross Merivale Road to service the Pineglen area; however, residences in this area are predominantly serviced by wells.

The greatest impact on the existing Municipal water supply system will be between Slack Road and Cassone Crescent where Merivale Road is proposed to be grade separated. The proposed work will affect the 406mm diameter watermain that runs along Merivale Road that services many residences, industries and businesses in the immediate Study Area. The water service to St. Monica School will also be affected by the proposed work.

Figure 42: Merivale Watermain Infrastructure



Note: Refer to Appendix G for full size diagram

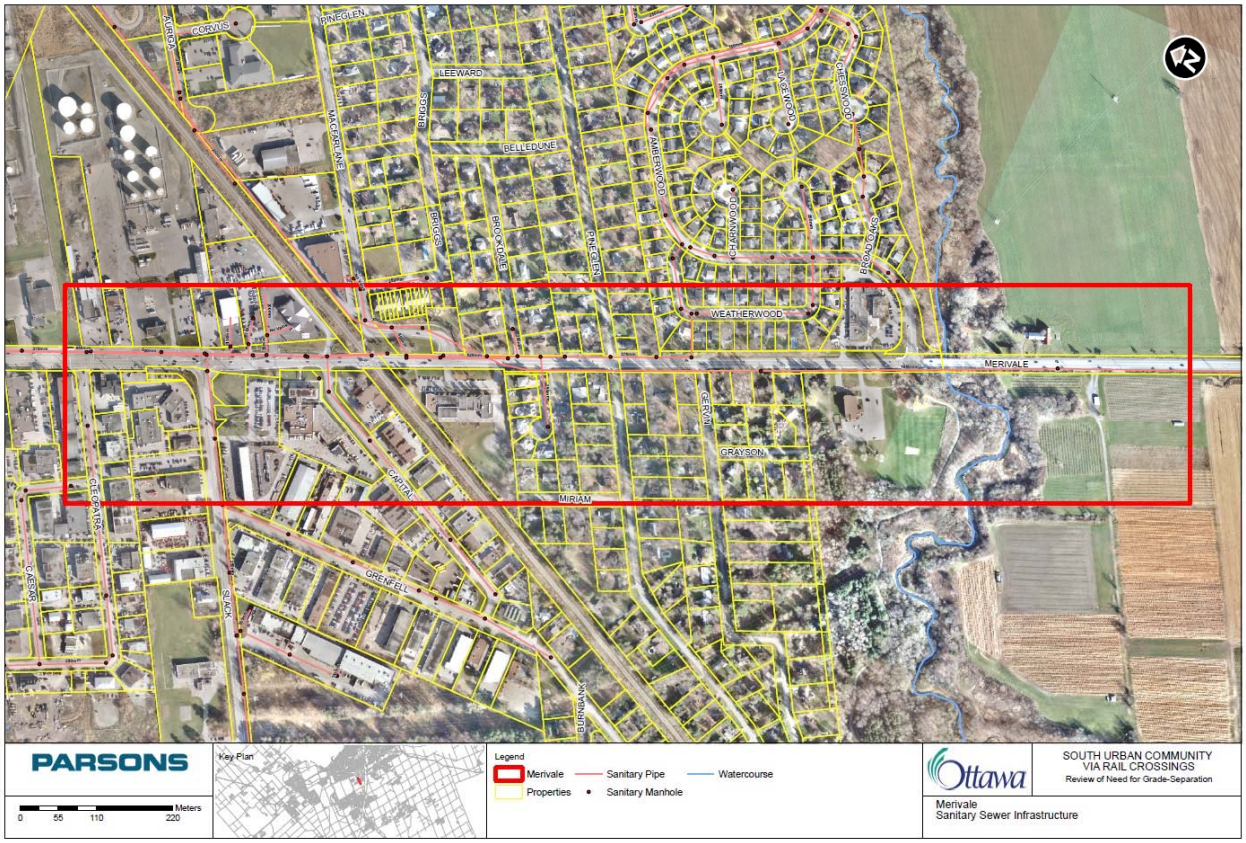
Sanitary Sewers: A network of sanitary sewers runs along Merivale Road. Separate sanitary sewer systems run on either side of the VIA Rail Line; one running northward and another running southward. The remaining residences in the Pineglen area have individual private sewage systems. The sanitary sewer network on the South side of the VIA Rail Line includes:

- A 375mm diameter sewer servicing residences around the Amberwood and Weatherwood Crescents;
- A 525mm diameter sewer that runs northwards towards MacFarlane Road; and
- The 1650mm diameter West Rideau Trunk Collector.

A 450mm diameter sewer and a 300mm diameter sewer cross the VIA Rail Line and run northwards on Merivale Road. The industrial and commercial areas on the North side of the VIA Rail Line are predominantly serviced by the City's sanitary sewer system. The greatest impact by the proposed grade separation on the existing sanitary sewer system would be between Slack Road and Cassone Crescent. Any residences, businesses and industries that are serviced along Merivale Road including St. Monica School would also be affected by the proposed work. The following sanitary sewers will be affected by the proposed work:

- North and South side of the VIA Rail Line
- The 375mm diameter sewer on the east side of Merivale Road;
- The 525mm diameter sewer on the east side of Merivale Road;
- The 1650mm diameter trunk sewer that crosses Merivale Road approximately 20m north of Brookdale Road which then runs on the west side of Merivale Road.
- The 300mm diameter sewer on the east side of Merivale Road;
- The 450mm diameter sewer on the east side of Merivale Road;
- The 250mm diameter sewer that crosses Merivale Road at Capital Drive.

Figure 43: Merivale Sanitary Infrastructure



Note: Refer to Appendix G for full size diagram

Storm Sewers: A network of storm sewers runs along Merivale Road. Similar to the sanitary sewer system, separate storm sewer systems run on either side of the VIA Rail Line; one running northwards and another running southward.

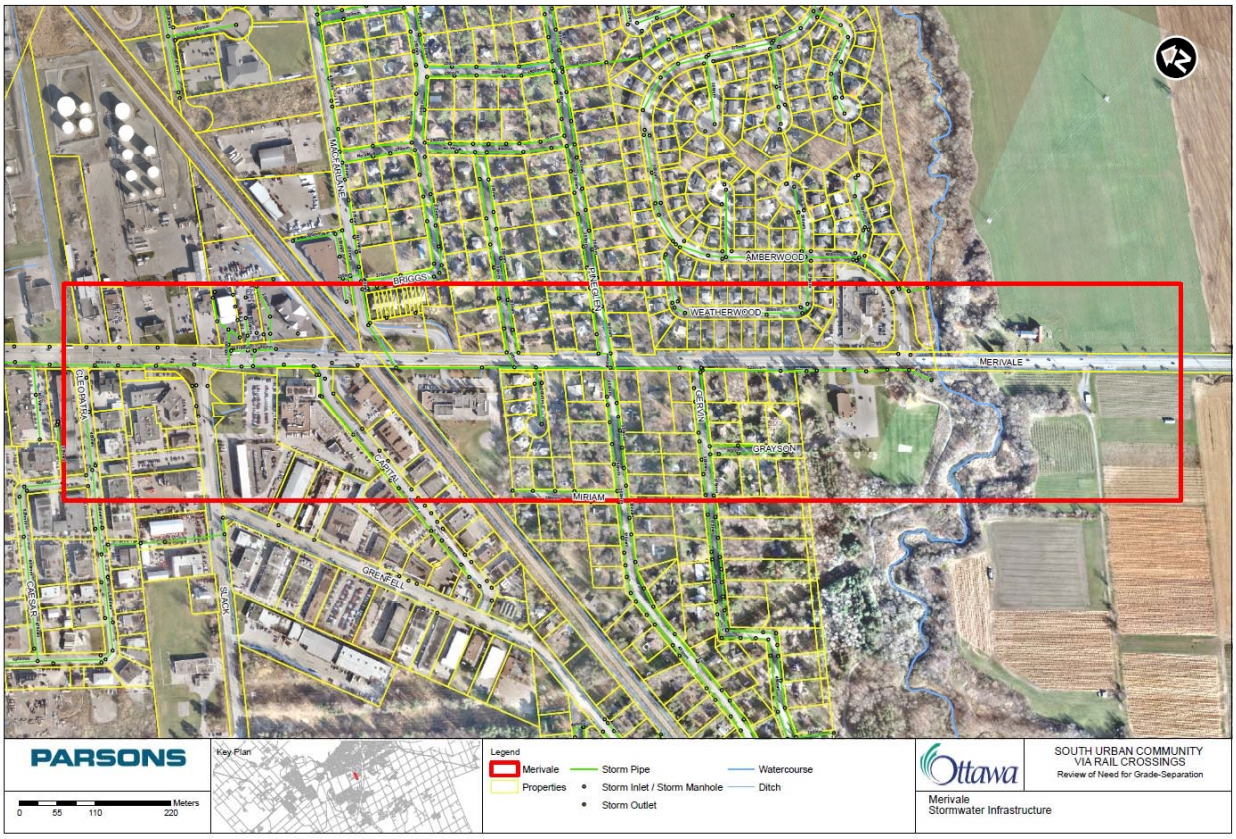
The storm sewer system on the South side of the VIA Rail Line consists of a 525mm diameter pipe that crosses Merivale Road approximately 50m north of MacFarlane Road. This storm sewer runs along the west side of Merivale Road eventually discharging into the Black Rapids Creek. This 525mm diameter sewer also picks up road drainage in the Pineglen area.

The storm sewer system on the North side of the VIA Rail Line consists of a 900mm diameter pipe that runs along the west side of Merivale Road from Capital Drive northwards passed Slack Road. This 900mm diameter storm sewer picks up drainage from the commercial and industrial areas along Merivale Road.

Drainage along Merivale Road consists of a curb and gutter system which is currently drained towards its west side. Surface water runoff drains into curb inlets that enter the storm sewer system beneath Merivale Road.

The greatest impact on the existing storm sewer system will be between Slack Road and Cassone Crescent where Merivale Road is proposed to be grade separated. Both the 525mm diameter and 900mm diameter storm sewers will be affected by this proposed work. Also, the 375mm diameter storm sewer that carries drainage from Brookdale Road will also be affected by the proposed work.

Figure 44: Merivale Stormwater Infrastructure



Note: Refer to Appendix G for full size diagram

3.9.2 WOODROFFE AVENUE

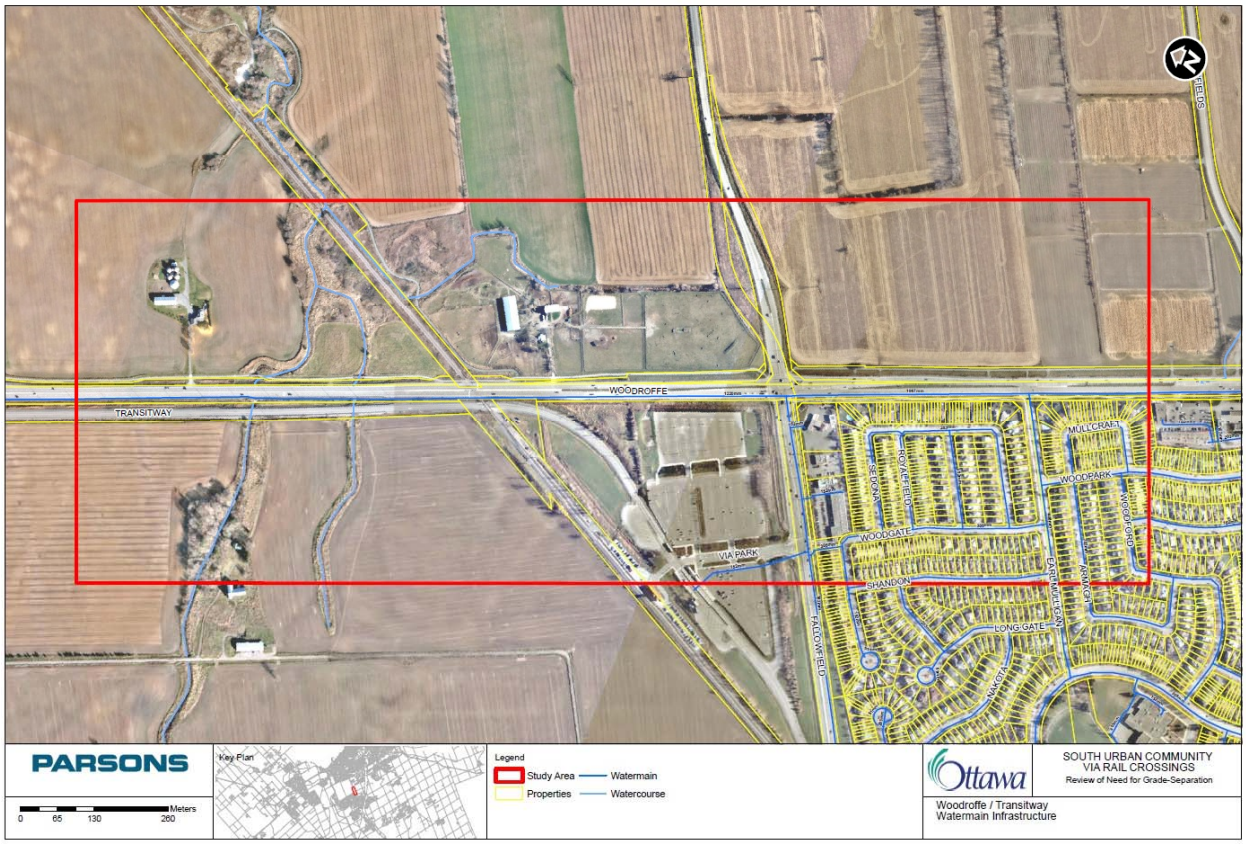
Watermains: A 1220mm diameter transmission main runs on the west side of Woodroffe Avenue between the road and transitway. From Vaan Drive to the rail crossing the transmission main alignment is partly under the road or in the paved shoulder. From the rail crossing to the Woodroffe/Fallowfield intersection the transmission main alignment is in the north bound right lane to Fallowfield Road where it turns west and terminates at the connecting 1067mm watermain under the west side of Woodroffe Avenue immediately south of Fallowfield Road.

Transmission mains, which are also considered to be backbone infrastructure, are very important as they provide movement of water from sources such as treatment plants and other pressure zones to the feedermains of the distribution system. Due to the size and purpose the catastrophic failure of such would cause significant property damage and/or environmental damage.

This 1220mm diameter transmission main is part of the "Woodroffe Watermain Replacement" project. However, at present time, this proposed replacement project has been put on hold.

This transmission watermain runs beneath the VIA Rail Line and will be impacted by the proposed work.

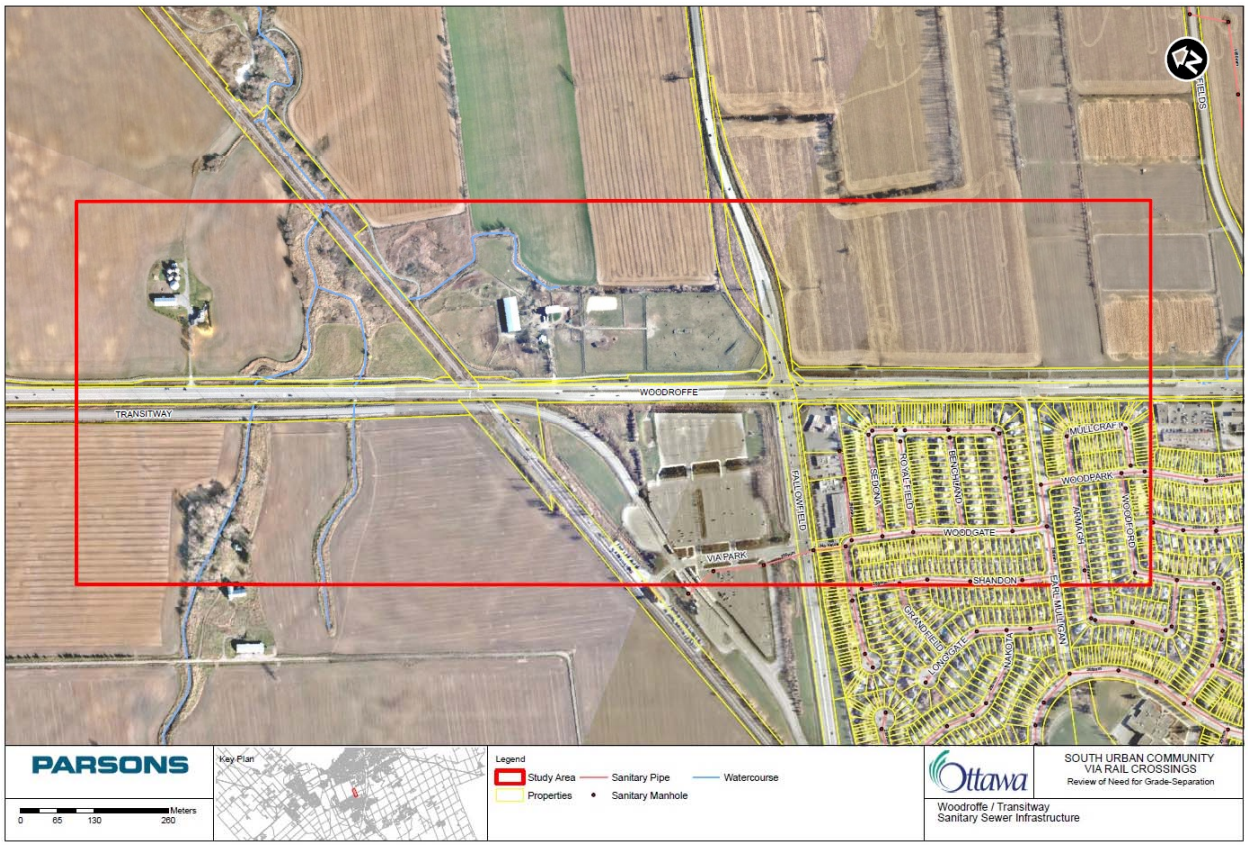
Figure 45: Woodroffe / Transitway Watermain Infrastructure



Note: Refer to Appendix G for full size diagram

Sanitary Sewers: There are no sanitary sewers in the Woodroffe Road Study Area that would be impacted by the proposed work.

Figure 46: Woodroffe / Transitway Sanitary Infrastructure

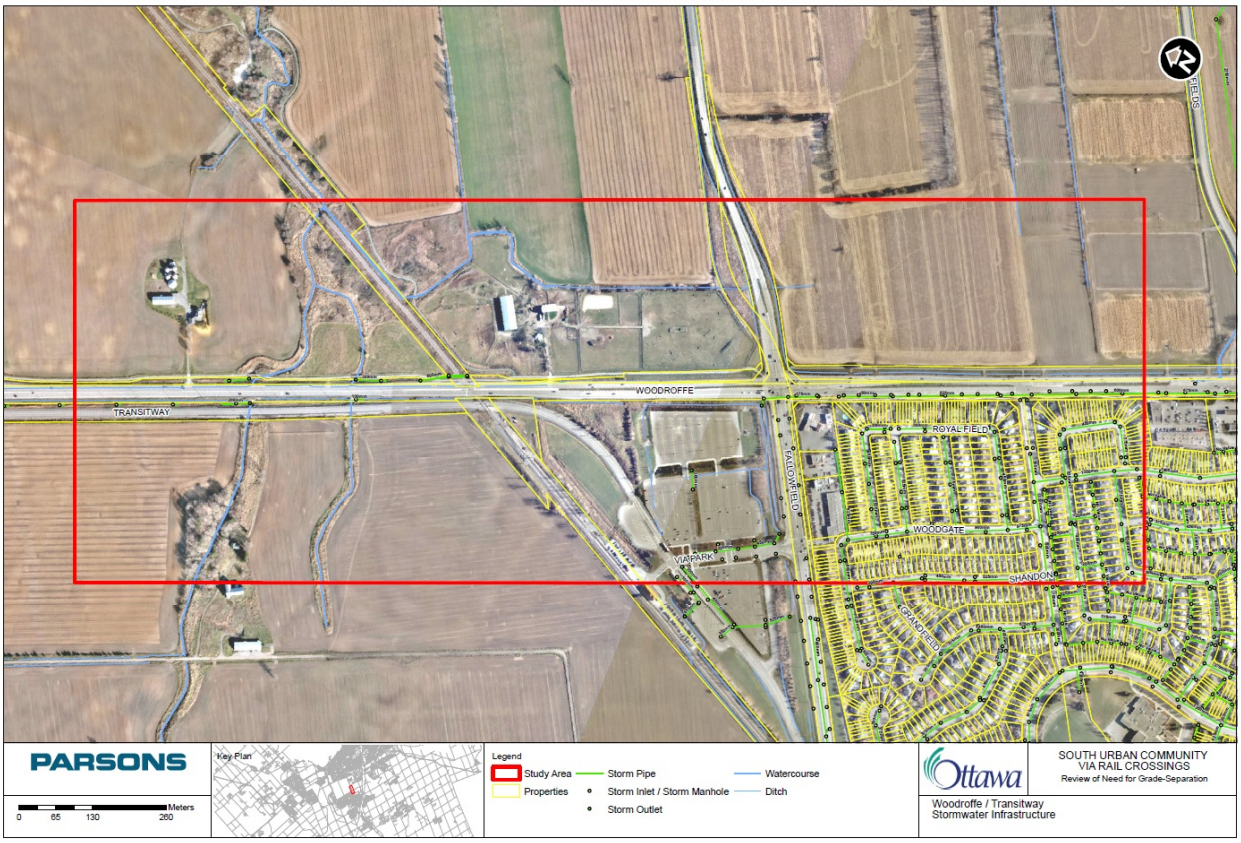


Note: Refer to Appendix G for full size diagram

Storm Sewers: Surface water runoff drains to ditches on both sides of Woodroffe Avenue. Once the ditch reaches the VIA Rail Line, two 600mm diameter culverts run beneath the rail embankment and multi-use path. These culverts then discharge into the roadside ditch that continues on the north side of the VIA Rail Line which eventually flows into Black Rapids Creek approximately 150m north of the railway. As the crossing of the VIA Rail Line at Woodroffe Avenue is proposed to be grade separated, the drainage system along this section of road would need to be re-designed.

Surface water is easier to manage on an overpass as it can naturally drain with the road grade. On the other hand, underpasses are more challenging to drain and a pumping station would be required to drain the sump at the grade separation with the railway. The road runoff would need to be pumped to a stormwater management facility such as a retention pond or a roadside ditch (preferably a swale) that could manage both water quantity and quality issues.

Figure 47: Woodroffe / Transitway Stormwater Infrastructure



Note: Refer to Appendix G for full size diagram

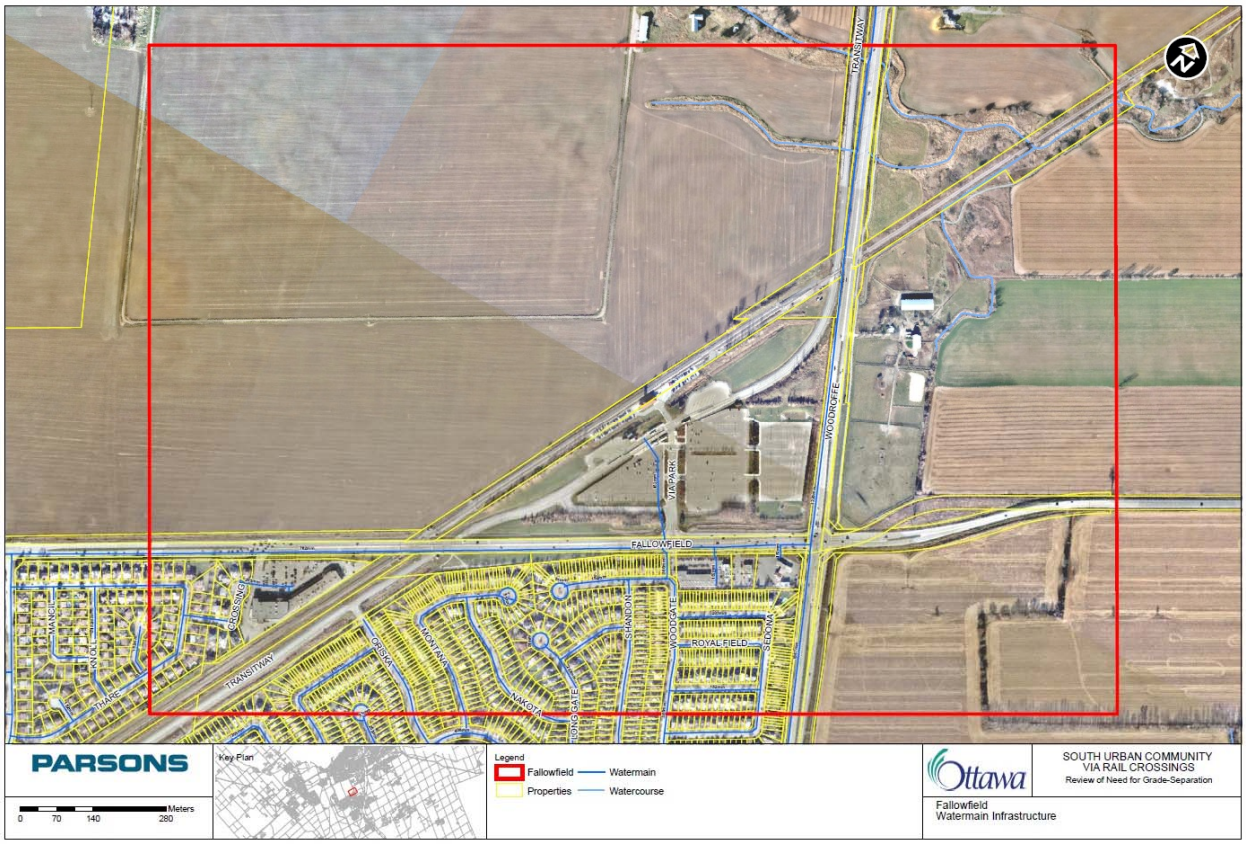
3.9.3 FALLOWFIELD ROAD

Watermains: A 762mm diameter transmission main runs on the south side of Fallowfield Road between the road and transitway. Transmission mains, which are also considered to be backbone infrastructure, are very important as they provide movement of water from sources such as treatment plants and other pressure zones to the feedermains of the distribution system. Due to the size and purpose the catastrophic failure of such would cause significant property damage and/or environmental damage.

This 762mm diameter transmission main is part of the "Woodroffe Watermain Replacement" project. However, at present time, this proposed replacement project has been put on hold.

This transmission watermain runs beneath the VIA Rail Line and will be impacted by the proposed work.

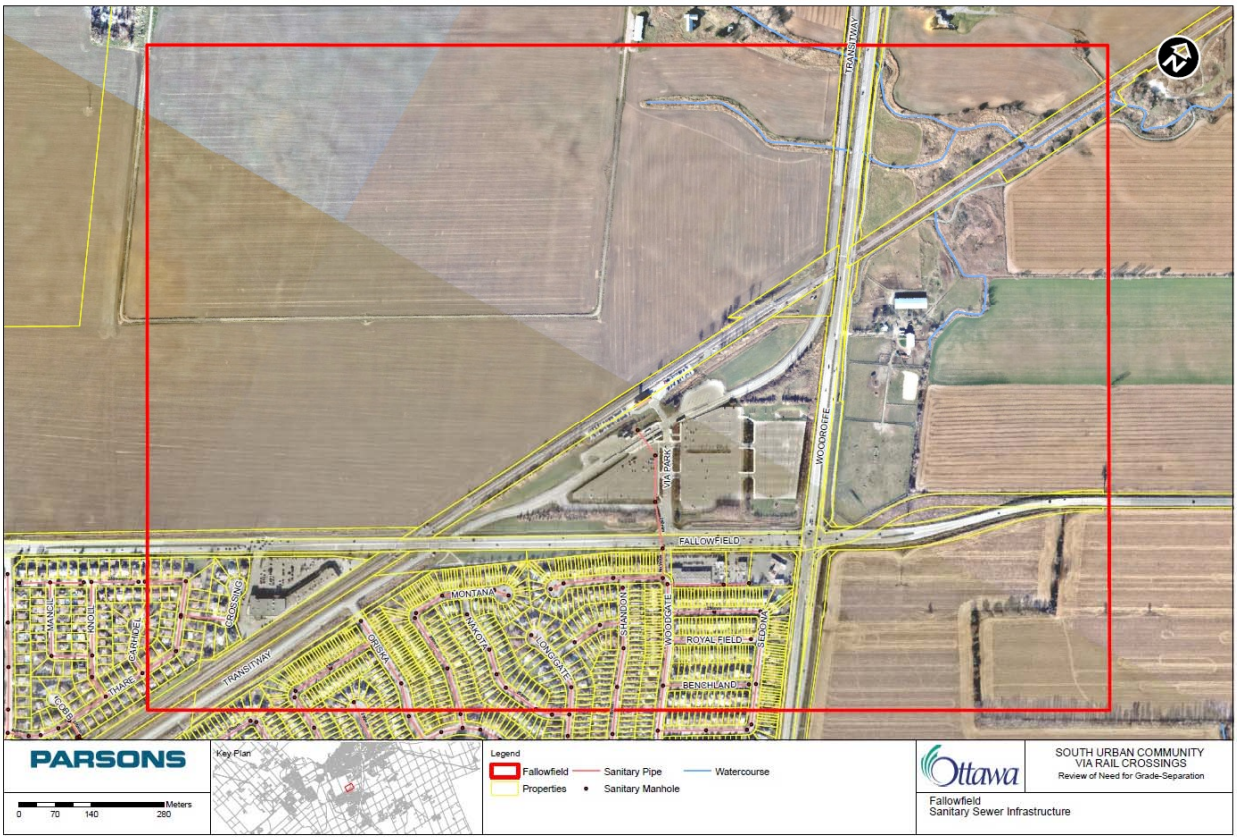
Figure 48: Fallowfield Watermain Infrastructure



Note: Refer to Appendix G for full size diagram

<u>Sanitary Sewers</u>: There are no sanitary sewers in the Fallowfield Road Study Area that would be impacted by the proposed work.

Figure 49: Fallowfield Sanitary Infrastructure



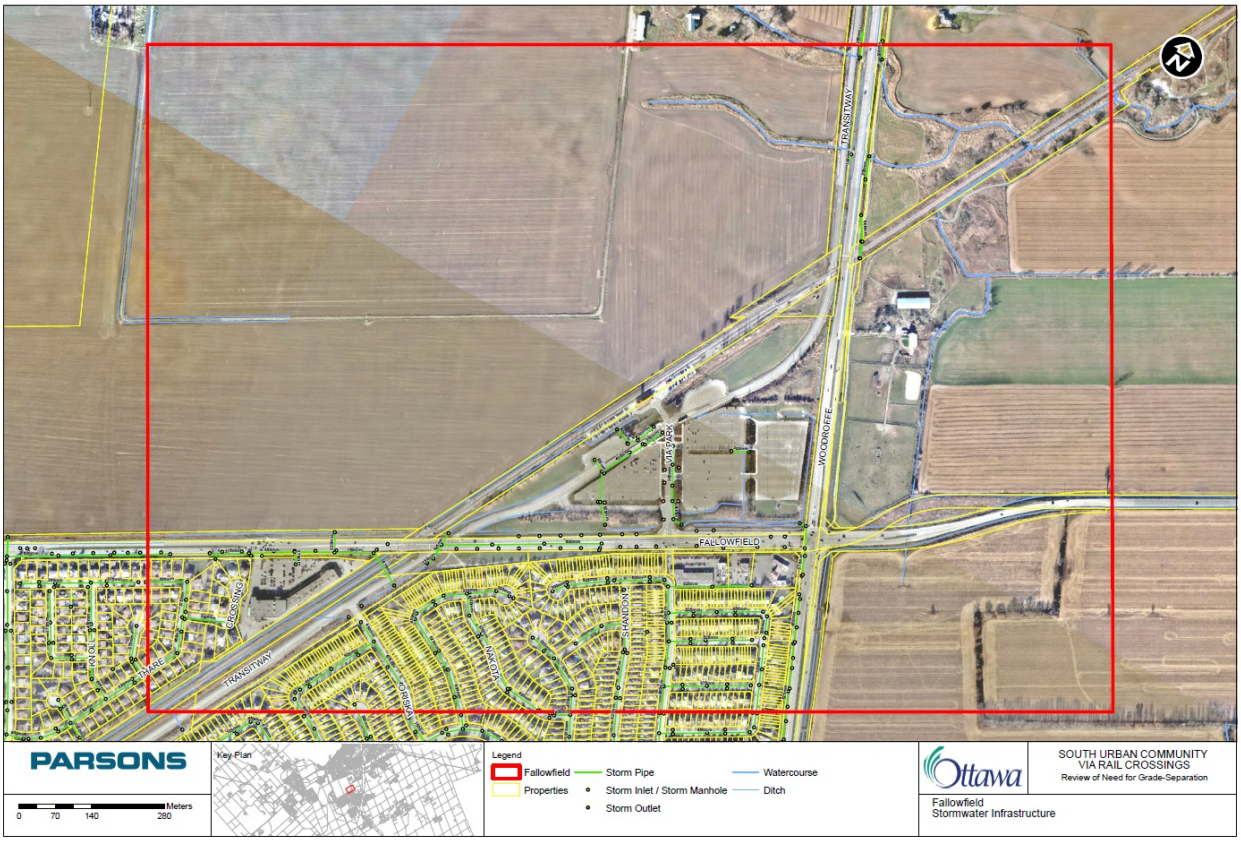
Note: Refer to Appendix G for full size diagram

<u>Storm Sewers:</u> Storm runoff within the Fallowfield Road Study Area drains to a large fenced-in swale on the south side of Fallowfield Road. This swale runs parallel to the Transitway on its east side. On the east side of the VIA Rail Line, a 600mm diameter storm sewer that runs westwards on Fallowfield Road picks up roadside drainage and discharges it into the swale. A ditch on the north side of Fallowfield Road is connected to the swale via a 525mm diameter culvert that crosses the road.

On the west side of the VIA Rail Line a 750mm diameter storm sewer runs beneath the multi-use path which is parallel to Fallowfield Road. Drainage from Fallowfield Road discharges into the 750mm diameter sewer. The south side of the road discharges directly into the sewer via curb inlets and drainage on the north side of the road first enters a ditch which is connected to the 750mm diameter sewer via culverts at low points. The 750mm diameter sewer ultimately discharges to the large swale that runs parallel to the Transitway on the south side of Fallowfield Road. The following storm sewers and culverts will be impacted by the proposed work:

- East side of the VIA Rail Line
- The 600mm diameter storm sewer that runs along Fallowfield Road in the east bound lane;
- The 525mm diameter culvert that connects the ditch north of Fallowfield Road to the swale on the south side of the road.
- West side of the VIA Rail Line
- The 750mm diameter storm sewer that runs along Fallowfield Road beneath the multi-use path;
- The 525mm diameter culvert that crosses Fallowfield Road approximately 125m west of the VIA Rail Line;
- The 675mm diameter culvert that crosses the VIA Rail Line and Transitway on the south side of Fallowfield Road.

Figure 50: Fallowfield Stormwater Infrastructure



Note: Refer to Appendix G for full size diagram

As the crossing of the VIA Rail Line at Fallowfield Avenue is proposed to be grade separated, the drainage system along this section of road would need to be re-designed.

Surface water is easier to manage on an overpass as it can naturally drain with the road grade. On the other hand, underpasses are more challenging to drain and a pumping station would be required to drain the sump at the grade separation with the railway. The road runoff would need to be pumped to a stormwater management facility such as a retention pond or a roadside ditch (preferably a swale) that could manage both water quantity and quality issues.

3.9.4 JOCKVALE ROAD

Watermains: There are no watermains that run along Jockvale Road which would be impacted by the proposed work. However, the area encompassing Rabo Health Care Services, Barrhaven Non Profit Housing, and Barrhaven United Church located in a “vulnerable services area”.

Sanitary Sewers: A 400mm diameter sanitary sewer that runs parallel to the VIA Rail Line, crosses Jockvale Road approximately 20m east of the railway. This sanitary sewer will be impacted by the proposed work.

Storm Sewers: There are no storm sewers in the Jockvale Road Study Area that would be impacted by the proposed work.

4.0 DEVELOPMENT AND EVALUATION OF GRADE SEPARATION OPTIONS

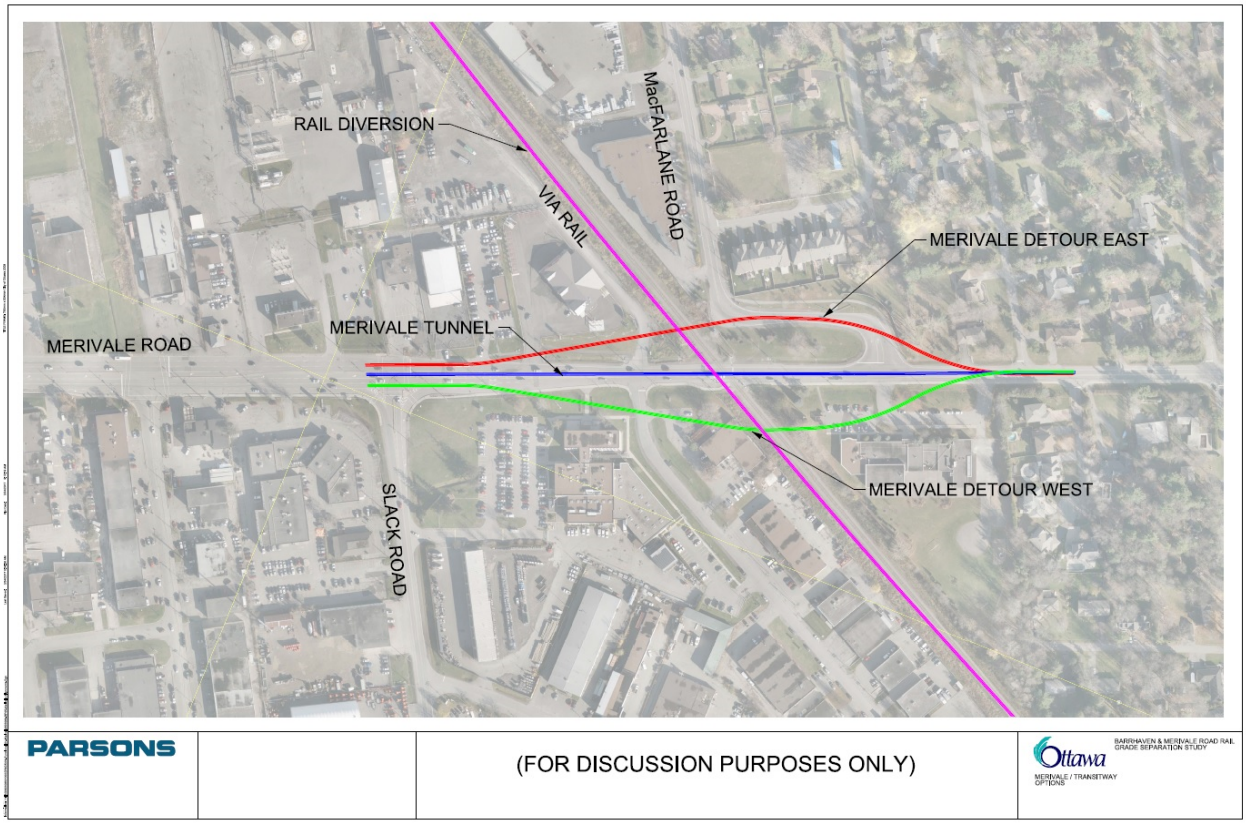
4.1 GRADE SEPARATION AT MERIVALE ROAD

As noted in Section **2.1 Merivale Road Crossing** the land use at the Merivale crossing consists of residential, local businesses, active recreational areas, as well as the St. Monica School located at the southwest corner of the crossing. Based on the current and future exposure rates discussed in Section 3.6 the need for grade separation at Merivale Road is recommended. Various issues were identified and reviewed for the Merivale Road crossing and options were prepared and evaluated. The following sections provide additional details on the reviewed options.

4.1.1 MERIVALE CHALLENGES AND OPPORTUNITIES

Several options were reviewed and considered for the grade separation of Merivale Road. Select conceptual drawings illustrating the various options can be found in **Appendix A**. Various options considered for Merivale are illustrated in **Figure 51: Initial detour options considered for Merivale** below. **Table 23: Consideration of Options for Merivale Road** below summarized potential impacts and opportunities associated with each option.

Figure 51: Initial detour options considered for Merivale



Note: Refer to Appendix G for full size diagram

Table 23: Consideration of Options for Merivale Road

OPTION	CHALLENGES	OPPORTUNITIES
Overpass - Road over Rail	• Merivale Road closure may be required during construction, road detour would require significant property acquisition. • Potential use of lightweight fill over sensitive soils. • Reduction of privacy to residential areas. • Increased noise, noise barriers may be required. • Access disruptions to adjacent property • Transit routes impacted during construction. • Disruption to St. Monica School would require relocated access as well as parking lot modifications. • Driveway relocation required to Suds Car Wash and the constrained parcel of land directly east. • Private wells may be at risk due to construction dewatering or contamination. • Overhead utilities would need to be relocated. • Geotechnical constraint; poor bearing soils; ground water concerns. Light weight fill may be required. • Impacts to sidewalks and spine bike route during construction. • Road closures during construction to accommodate staging. • Larger footprint required may result in greater land impacts or acquisition requirements.	• No rail detour required. • Potential to create new pathway connections, under new structure and along Black Rapids Creek (on NCC property). • Surface water is easier to handle as it can naturally drain along the sloped road grade. • Drainage can be conveyed in a gravity storm sewer system. • Opportunity to improve the corridor. • Fewer impacts to deep municipal infrastructure. • Improved crossing safety to separate road and rail traffic. • Opportunity to improve left turn capacity from Merivale Road to MacFarlane Road.
Underpass - Road Under Rail	• Road and rail detours required. • Access disruptions to adjacent property • Transit routes impacted during construction. • Disruption to St. Monica School would require relocated access as well as parking lot modifications. • Driveway relocations required to Suds Car Wash and the constrained parcel of land directly east. • Private wells may be at risk due to permanent drawdown of ground water table, construction dewatering, or construction contamination. • Underpass would create a sump that cannot be drained by gravity to adjacent storm water conveyance systems. • Pump station and storm water treatment facility requirements.	• Potential to create a new path along Black Rapids Creek (on NCC property) • Opportunity to improve drainage. • Opportunity to improve the corridor. • Improved crossing safety to separate road and rail traffic. • Opportunity to improve left turn capacity from Merivale Road to MacFarlane Road. • Reduced permanent footprint.

	• Potential impacts to Black Rapids Creek as storm outlet. • Overhead utilities would need to be relocated. • Geotechnical constraints; poor bearing soils; ground water concerns. • Unstable soils may result in additional structural foundation requirements for retaining walls and bridge abutments. • Impacts to sidewalks and spine bike route during construction. • Road closures during construction to accommodate staging.	
Railway over or under the existing road	• Major rail service disruptions during construction to raise/lower track approach grades. • Introduction of increased permanent track grades/slopes which may impact train performance. • Significant impacts to property adjacent to railway. • Impacts a significantly larger footprint. • Very high costs. • Track detour required, railway right-of-way constraints restrict this option. • Staging difficulties (maintaining train schedules)	• Reduced road traffic disruptions during construction. • Limited impacts to local sewers and utilities. • Improved crossing safety to separate road and rail traffic.
Tunnel from Slack Road to Amberwood	• Difficult to construct given geotechnical constraint; poor bearing soils; ground water concerns. • May require open cut construction methods requiring road closure during construction. • Major intersection modifications at Slack/Merivale and Amberwood/Merivale for new tunnel portals. • Potential impact to air quality. • Limited opportunity to improve cycling and pedestrian facilities • Difficult to provide access to adjacent local roads. Isolates MacFarlane Road. • Private wells may be at risk due to permanent drawdown of ground water table, construction dewatering, or construction contamination. • Impacts to multi use pathway and potential disruption to greenbelt access. • Impacts to sensitive Black Rapids corridor. • Highest cost option. • Staging difficulties during construction.	• Limited visual signature. • Limited to no noise impacts. • Improved crossing safety to separate road and rail traffic.
Combination of lowering rail and	• Road and rail detours required, significant property impacts.	• Balanced impact to railway and roadway. • Potential to create a new pathway connection under new structure.

raising Merivale Road	• Merivale Road closure may be required during construction. • Pump station and storm water treatment facility requirements for railway. • Reduction of privacy to residential. • Impacts to adjacent property. • Difficult to provide access to adjacent roads and driveways. • Major rail service disruptions during construction to raise/lower track approach grades. • Introduction of increased permanent track grades/slopes which may impact train performance. • Impacts a larger footprint to properties adjacent to the roadway and railway. • Property impacts adjacent to rail tracks. • Driveway relocation required to Suds Car Wash and the constrained parcel of land directly east. • Private wells may be at risk due to construction dewatering or contamination. • Impacts to sidewalks and spine bike route during construction. • Road closures during construction to accommodate staging. • Detour for trains during construction • Complex staging.	• Road drainage easier to handle as it can be conveyed in a gravity storm sewer system. • Less impacts to deep municipal infrastructure. • Improved crossing safety to separate road and rail traffic. • Opportunity to improve left turn capacity from Merivale Road to MacFarlane Road.

4.1.2 MERIVALE SCREENING CRITERIA MATRIX

The **Table 24: Merivale Screening Criteria** illustrates the evaluation criteria and options that were considered in selecting a preferred option for Merivale Road.

Table 24: Merivale Screening Criteria

MERIVALE SCREENING CRITERIA	(A) Overpass Road Over Rail	(B) Underpass Road Under Rail	(C) Railway over or under the road	(D) Tunnel from Slack Road to Amberwood Drive	(E) Combination of lowering rail and raising the road
Social Environment					
Impacts to sensitive receptors (e.g. residences, schools, churches)	🟠	🟡	🔴	🟡	🔴
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟡	🟢	🟠	🔴	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🟠	🟠	🟡	🔴	🔴
Impacts to Greenbelt Lands (e.g. fragmentation)	🟢	🟢	🟢	🟡	🟢
Impacts to infrastructure (e.g. major municipal infrastructure, private wells, utilities)	🟠	🟠	🟡	🔴	🟠
Natural Environment					
Impacts to natural environment features	🟡	🟡	🟡	🟠	🟡
Economic Environment					
Operating Costs	🟡	🟠	🟡	🔴	🟡
Construction Costs	🟠	🟠	🔴	🔴	🔴
Construction investment (e.g. length of construction time, complexity)	🟠	🟠	🔴	🔴	🔴
Physical Environment					
Geotechnical influences on construction (e.g. managing ground water, poor bearing soils)	🟠	🟠	🟡	🔴	🟡

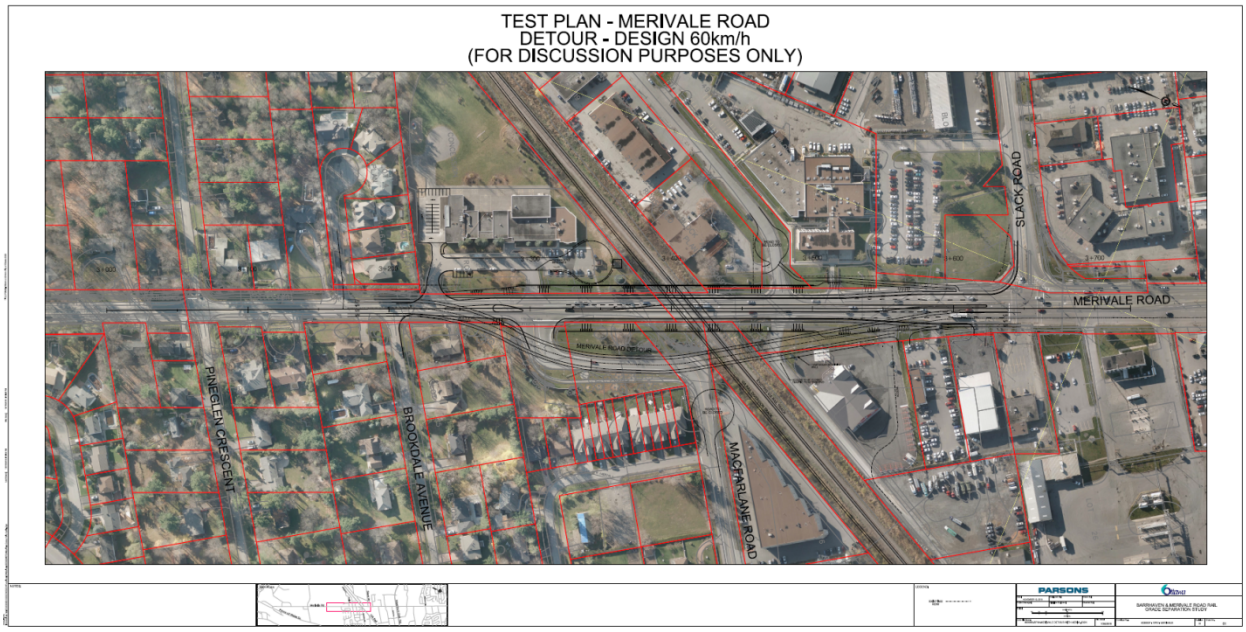
Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.1.3 MERIVALE PREFERRED GRADE SEPARATION OPTION

From the options presented in **Table 24: Merivale Screening Criteria** a preferred Option B (Underpass – Road under Rail) was chosen to lower Merivale Road below the railway line using an underpass structure. Options C, D, and E were deemed to have too severe an impact in numerous areas so they were not considered further. Option A was also a viable option however it was not chosen due to a perceived issue with privacy that would result by having the raised overpass next to residences. To further develop the Option B underpass at Merivale, a conceptual test plan view of the temporary detour was created and is shown below in **Figure 52: Merivale Road Detour Test Plan**. The selected Option B is also consistent with the option selected in the previously approved EA. The future configuration from the EA is also displayed in **Figure 53: Merivale EA Preferred Option (from MCEA, McCormick Rankin Corp., 1997)**.

Figure 52: Merivale Road Detour Test Plan



Note: Refer to Appendix G for full size diagram

Figure 53: Merivale EA Preferred Option (from MCEA, McCormick Rankin Corp., 1997)

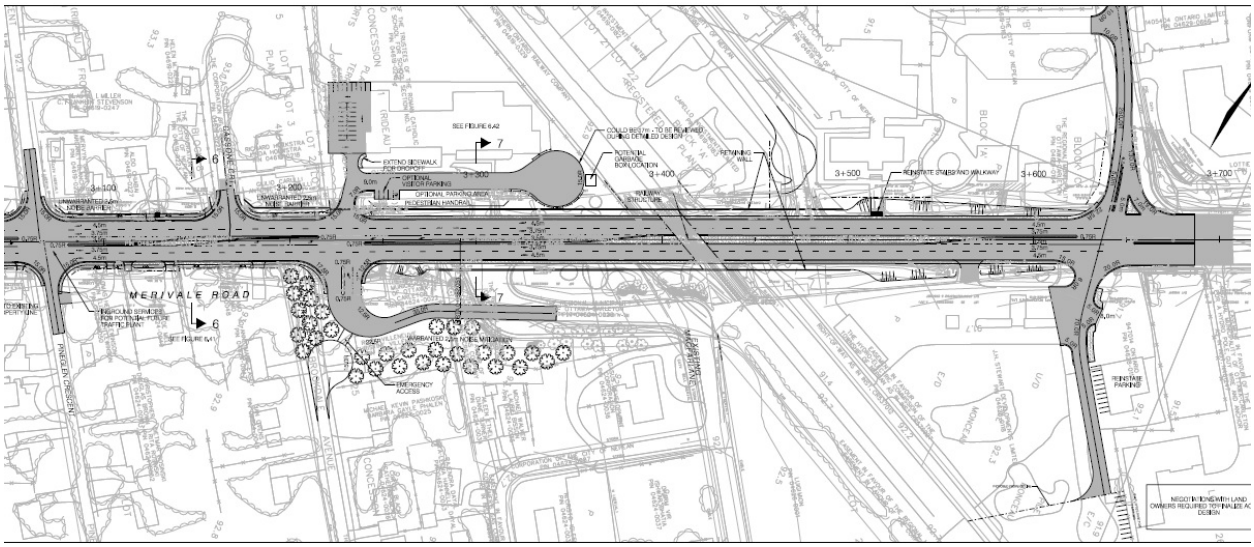
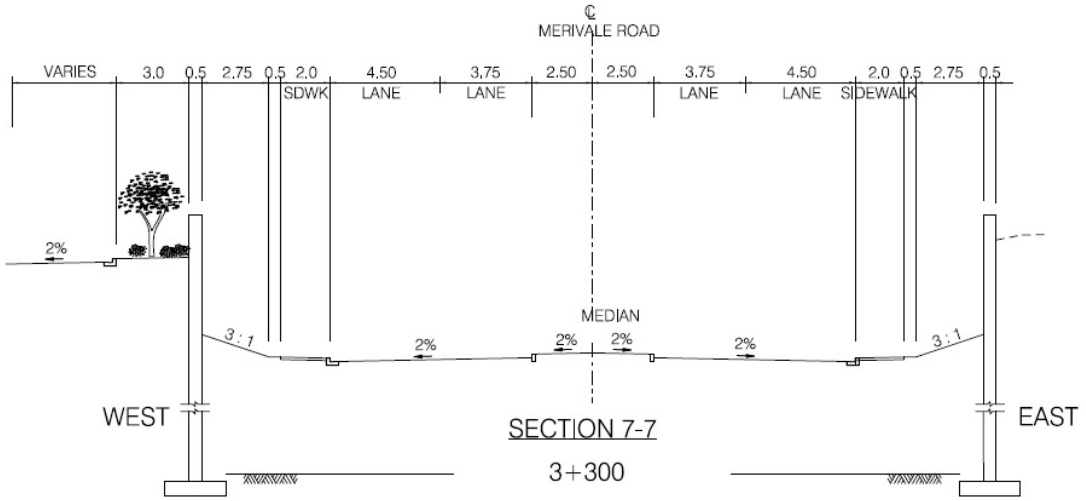


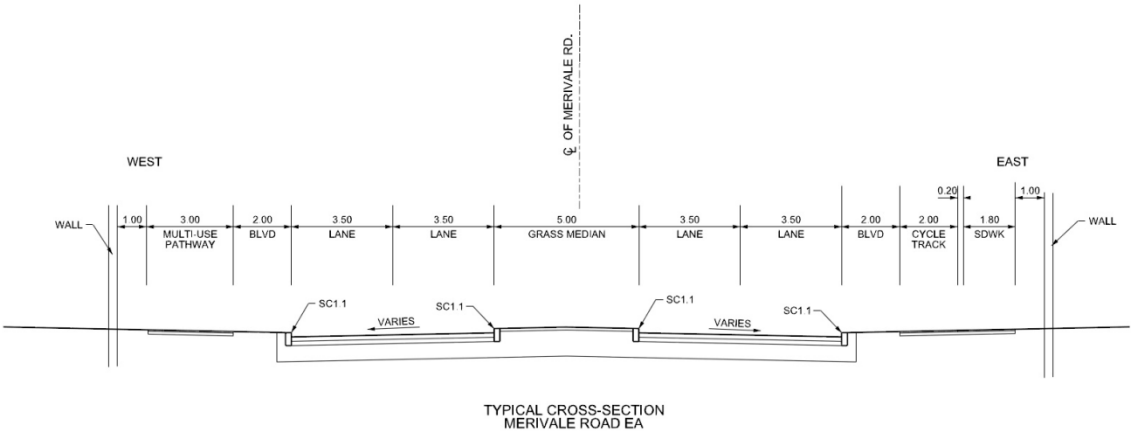
Figure 54: Conceptual EA 32m wide cross section at underpass



Note: Image taken from Municipal Class EA, McCormick Rankin Corp., 1997

The conceptual cross section from the previously completed EA Study at the underpass (shown above) used wider shared lanes for cyclists. The wall to wall width of the above cross section is 32m. This is no longer consistent with City of Ottawa standard practices and guidelines so an updated section with potential active transportation alternatives is illustrated below for future consideration. The new cross section uses the same clear span width under the bridge but reallocates space to either a 3.0m multi-use pathway option, shown on the left/West side, or 2.0m raised bi-directional cycle track option shown on the right/East side.

Figure 55: Conceptual underpass 31m wide cross section with active transportation options.



TYPICAL CROSS-SECTION
MERIVALE ROAD EA

4.1.4 MERIVALE INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Merivale Road at-grade crossing location are listed below.

- As a result of implementing grade separation the pedestrian and cycling facilities will also be impacted. The City should look into ways to improve the Merivale Road pedestrian sidewalks (both sides) and cycling facilities between Slack Road and MacFarlane Drive. The eventual design for the grade separated facilities will need to recommend active transportation facilities as well. Consideration should be given to install separate facilities and warning system on the east side of the crossing and/or improvements to the existing west side system to allow for dedicated pedestrian/cycling movements. A multi-use pathway connection would be a viable option.
- Due to the narrow corridor space, it will be necessary to review and ensure that the works maintain at-grade crossing sight lines as per the regulation.
- Careful site plan control and/or restrictions to adjacent development that may infringe on the required land and driveway access needs for a grade separation solution. It is noted that recent redevelopment of lands to the north and east of the crossing (Suds Car Wash, Enterprise Rent a Car agency, etc.) have created additional access and detour road constraints.
- Consideration should be given to shift the MacFarlane/Merivale intersection further south to the ultimate configuration. It is understood that this intersection was reconstructed and moved as far south as possible within the current City owned property limits. This measure helped improve the available storage requirements for southbound left turning vehicles. However, the storage length is still considered to be deficient and vehicles have been observed to back up across the railway tracks on occasion. A relocation to the ultimate southerly location will provide better storage capacity, lower the risk of vehicles stopping on the tracks, and remove the need for a fifth (5th) lane at the road/rail crossing. This measure will require the acquisition of two properties as identified in the previously completed EA.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.

4.1.5 MERIVALE SUMMARY

The preferred option for the Merivale Road crossing is to grade separate the road under the existing rail. Options which involved raising or lowering the rail were rejected as they resulted in significant increases to the impacts on adjacent property, long term train performance impacts, as well as significant interruptions to train service during construction. There will be substantial impacts to property access which will need to be handled both during construction and for the final alignment. Due to a high ground water table there may be impacts to local properties that are currently on well systems. There may be a need to connect such residences to the City water supply. If the underpass cannot be drained to Black Rapids Creek through a gravity system then pumping may also be required resulting in additional operating costs and additional land requirement for a stormwater treatment facility.

It should be noted that the City is considering a widening to four lanes along the Merivale Corridor in the future, beyond the 2031 Transportation Master Plan horizon, so property acquisition may also be required before the project is undertaken to allow for proper right of way protection. The underpass should be designed to accommodate four lanes and should also consider active transportation requirements as this location is also part of the cycling network. Consideration should be given to the potential addition of a second track by VIA in the future. VIA has confirmed that all structures within the study boundary can be constructed for single track only but must have the required space and clearance to not restrict the construction of a two track structure in the future.

Impacts to the St. Monica School will result in changes to their private approach and property to accommodate bus turning and garbage pickups. Shifting of MacFarlane Road to create a new intersection just north of Brookdale will result in Brookdale Avenue being converted into a cul-de-sac and two homes will need to be removed to create the intersection (i.e. additional property acquisition which could result in years of up front work prior to construction).

Geotechnical challenges include slope stability issues along the Black Rapids Creek which may be a factor when installing a new outlet or modifying existing outlets. Poor bearing soils may require additional remediation in the design of the structure. Overhead utilities and deep municipal infrastructure in the vicinity will also need to be given careful consideration during design and construction. Based on the Historical Land Use Inventory review it is also anticipated that there may be impacted soils which will need to be mitigated during construction.

4.2 GRADE SEPARATION AT WOODROFFE AVENUE & SOUTHWEST TRANSITWAY

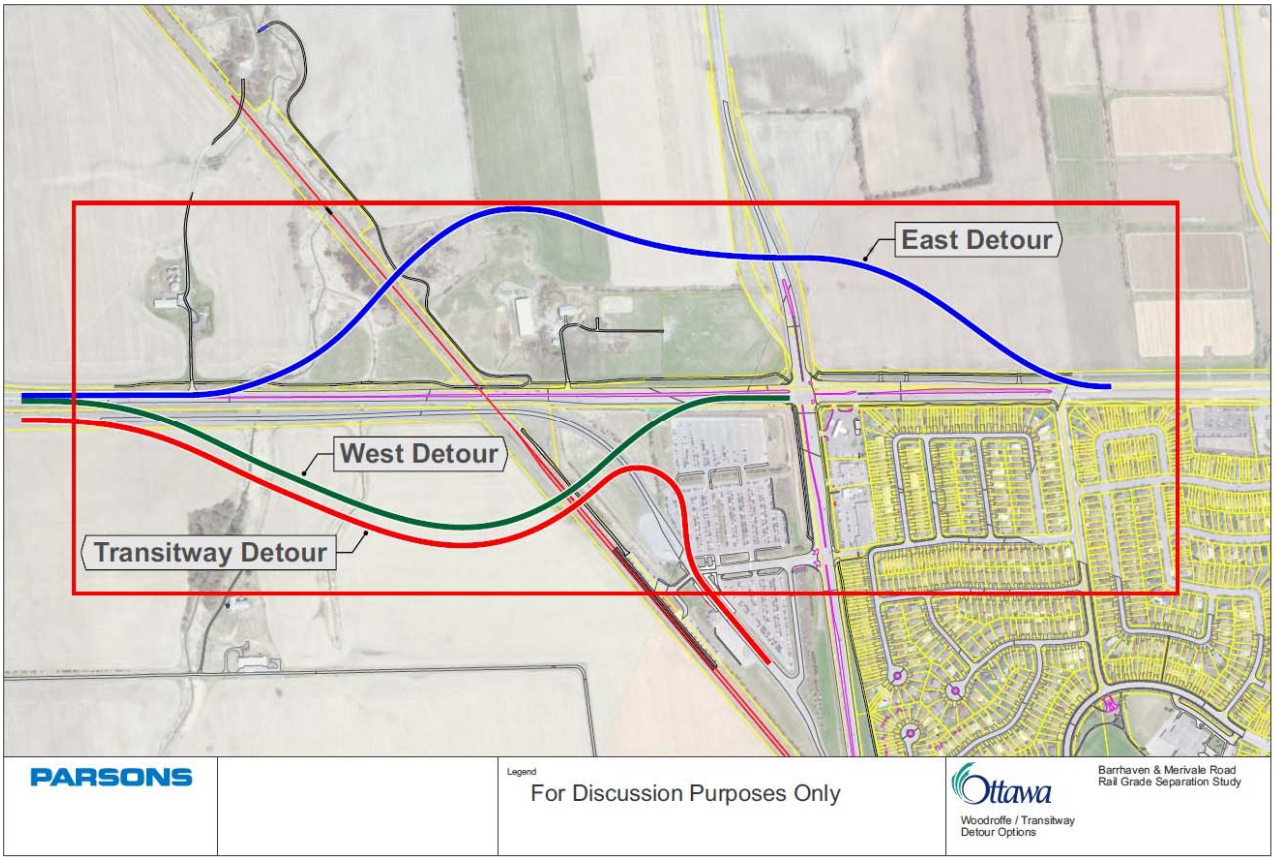
Given that the Woodroffe Avenue and Southwest Transitway at-grade crossings are directly adjacent to each other it was determined that constructing them separately would not be practical or efficient. Attempting to review detour options during construction requires a holistic view of both sites. As such, the two crossing locations will be treated as one project location for the sake of this study.

As noted in Section **1.4 Background Studies and Documentation** there were several studies completed at this location as part of the EA and by Golder where an Underpass, Road under Rail option, was the preferred recommendation. In subsequent investigations and reporting the recommendations changed as a better understanding of the poor ground conditions and amount of potential surface/ subsurface water pumping requirements indicated significant risks to public safety. The following sections comment on other options considered given the high risk and high cost determined for the EA recommended underpass scenario.

4.2.1 WOODROFFE / TRANSITWAY CHALLENGES AND OPPORTUNITIES

Several options were considered for grade separation of Woodroffe Avenue as shown in **Table 25: Woodroffe / Transitway Considered Options** below and as shown in Appendix B. There were also several detour options that were considered which are illustrated in **Figure 56: Initial detour options considered for Woodroffe Avenue and the South West Transitway**.

Figure 56: Initial detour options considered for Woodroffe Avenue and the South West Transitway



Note: Refer to Appendix G for full size diagram

Table 25: Woodroffe / Transitway Considered Options

OPTION	CHALLENGES	OPPORTUNITIES
Overpass Road over Rail	• Disruptions / detours required for road and existing multi-use pathway. • Potential disruptions to zoned environmental protection areas. • Disruptions to "natural link" areas. • Temporary disruptions to wildlife movements during construction. • Temporary impacts to NCC lands, farmed fields with existing tile drains. • Access disruptions to adjacent property. • Transit services impacted during construction. • Private wells may be at risk due to construction dewatering/ contamination. • Overhead utilities would need to be relocated. • Geotechnical conditions are not ideal for an overpass; light weight fill required. • Potential settlement impacts to deep municipal infrastructure; likely 1220mm watermain relocation required.	• Opportunity to create views and vistas of Greenbelt land. • No rail detour required. • Surface drainage is easier to manage as water can naturally drain with the positive road grade. • Potential to create a new eco passage along Black Rapids Creek (as requested by NCC). • Lower construction and operating cost than underpass option. • Limited residential near the site that would be sensitive to potential increased noise levels.
Underpass Road Under Rail	• Disruptions / detours required for road and existing multi-use pathway. • Potential disruptions to zoned environmental protection areas. • Disruptions to "natural link" areas. • Temporary disruptions to wildlife movements during construction. • Challenging drainage issue requires pump station and stormwater management facilities such as a retention pond or roadside ditch to manage water quantity and quality issues. • Impacts to deep municipal infrastructure. • Unstable slopes in Black Rapids Creek may result in additional engineering. • Underpass was the preferred option in the previous EA however geotechnical investigations after the EA revealed extensive geotechnical and drainage issues. • Hydrological issues would require extensive bedrock grouting to control groundwater. • Pumping capacity requirements present a high risk of flooding. • Would require a larger footprint for underpass excavations and stormwater treatment facility.	• Opportunity to improve drainage in the area if a stormwater facility is included. • Potential to create a new eco passage along Black Rapids Creek (as requested by NCC). • Opportunity to improve the corridor. • Improved crossing safety to separate road and rail traffic. • Opportunity to improve driveway access to adjacent properties. • Lower visual, noise, vibration impacts.

	• Temporary rail diversion / detour required. Temporary at-grade crossing on detour west of Woodroffe may not be feasible as there are two tracks and the station stop in close proximity.	
Combination Raise Rail and Lower Road	• Limited opportunity to revise rail profile given the close proximity to the existing station building and platform; near flat track conditions preferred within the station siding track. • Challenging drainage issue requires pump station and stormwater management facilities such as a retention pond or roadside ditch to manage water quantity and quality issues. • Impacts to deep municipal infrastructure. • Pumping capacity requirements present a high risk of flooding. • Disruptions / detours required for road and existing multi-use pathway. • Impacts to VIA Rail station. • Disruptions to zoned environmental protection areas. • Disruptions to "natural link" areas. • Temporary disruptions to wildlife movements during construction. • Potential need for lightweight fill over sensitive soils. • Impacts a larger footprint. • Property impacts adjacent to rail tracks. • Detour for trains during construction. • Complex staging for combined Woodroffe and Transitway construction. • Impacts to train safety (grade issues with nearby station). • Reconstruction of VIA platform and station elements required. • Very costly to create a rail detour.	• Geotechnical related risks and costs lower due to reduced depth of fill or excavation. • Reduced noise impacts. • Balanced impact to railway and roadway. • Potential to create a new pathway connection under new structure. • Road drainage easier to handle as it can be conveyed in a gravity storm sewer system. • Improved crossing safety to separate road and rail traffic.
Single Crossing Option Combines Woodroffe and Fallowfield at one crossing (Shown as a red line in figure above)	• Significant realignment to Fallowfield not preferred as it is a major east-west arterial route. Road closure will impact travel times. • Major permanent land requirement from the Greenbelt. • Significant loss of agricultural lands. • Removal of pass-by traffic from the commercial properties on Fallowfield Road, west of Woodroffe (restaurants, gas station, small businesses). • Difficult vehicle/ bus movements across new Fallowfield/Transitway intersection. • Would require another grade separation structure for conversion to LRT in the future.	• Maintains access to shopping center on south of Fallowfield • Capitalizes on City owned land • Less Impact to Greenbelt and agricultural activity • One crossing of Black Rapids Creek • Combined detour for Woodroffe and Fallowfield crossings.

East Detour	• Major Roadway cutting through the equestrian center will impact buildings and disrupt programming. • Complex movements to contend with at the Woodroffe/Fallowfield intersection. • Traffic Flow disruptions due to having two intersections so close. • Disruptions to pedestrians and cyclists • Equestrian center access is disrupted • Access to the VIA park and ride is out of the way • Infrastructure removal • Property impacts • Disruptions to zoned environmental protection areas • Length of facility requires use of NCC property • Disruptions to the "natural link" area • Multiple crossings of Black Rapids Creek • Expensive compared to other detour options • Restoration costs high • Unstable slopes in Black Rapids Creek may cause more costly engineering • Two overpass structure (over rail and over Fallowfield) • Longer facility to construct • Disruption to recently completed wetland restoration project along Black Rapids Creek.	• No disruptions to watermain or other municipal infrastructure • Opportunities to enhance Black Rapids Creek
West Detour	• Temporary disruptions to Transitway; buses would need to share the road with Woodroffe traffic. • VIA Station platform may need to be moved to accommodate the detour. • VIA second siding track may need to be shortened to avoid new two track crossing. • Disruption to agriculture activities • Disruptions to "natural link" areas • Potential impact to 1220mm watermain which may need to be relocated or crossed over during construction. • Potential for traffic to back up over the tracks if a T intersection is introduced to access the transit station. • Detour restoration costs. • Unstable slopes in Black Rapids Creek may require more costly engineering • Potential Memorial site impacts. • Temporary loss of Transit parking during construction.	• No impacts to equestrian center • Opportunity to recreate driveway access to farm lands on the west side of Woodroffe. • Capitalizes on City owned lands at Park and Ride. • Reduced crossing of Black Rapids Creek

Transitway Separate Transitway Detour	• Disruption to park and ride operations • LRT is a future consideration • Loss of transit parking area and snow storage • Disruptions to zoned environmentally sensitive areas • VIA Station platform may need to be relocated to accommodate the detour • Potential disruption / relocation of memorial site. • Larger footprint within Greenbelt lands for 6 lane cross section with buffer between Woodroffe and Transitway detours.	• Opportunity to improve transit movements through park and ride • Maintains a dedicated transit facility • Capitalizes use of City property • Avoids a signalized intersection to connect Transitway to Woodroffe
Road Closure	• Severe disruptions to north-south traffic capacity. • Extreme transit detour requirements. • Local access to farms and residences severed.	• Reduced construction period and costs. • Reduced construction footprint. • No impacts to Greenbelt lands.

4.2.2 WOODROFFE GRADE SEPARATIONS OPTIONS SCREENING CRITERIA MATRIX

The **Table 26: Woodroffe Screening** illustrates the evaluation criteria and options that were considered in selecting a preferred option for Woodroffe Avenue.

Table 26: Woodroffe Screening Criteria

WOODROFFE SCREENING CRITERIA	(A) Overpass Road Over Rail	(B) Underpass Road Under Rail	(C) Combination Raise Rail and Lower Road	(D) Single Crossing Option
Social Environment				
Impacts to sensitive receptors (e.g. residences, schools, churches)	🟡	🟡	🟡	🟡
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟠	🟠	🔴	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🟠	🟠	🔴	🔴
Impacts to Greenbelt Lands (e.g. fragmentation)	🟡	🟠	🔴	🔴
Impacts to infrastructure (e.g. major municipal infrastructure, utilities, private wells)	🟡	🟠	🔴	🔴
Natural Environment				
Impacts to natural environment features	🟢	🟢	🟠	🟡
Economic Environment				
Operating Costs	🟡	🟠	🟠	🟡
Construction Costs	🟡	🟠	🔴	🟠
Construction investment (e.g. length of construction time, complexity)	🟠	🟠	🔴	🟠
Physical Environment				
Geotechnical influences on construction (e.g. managing ground water)	🟡	🔴	🔴	🟡

Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.2.3 WOODROFFE DETOUR SCREENING CRITERIA MATRIX

The **Table 27: Woodroffe Detour Screening** below illustrates the evaluation criteria and options that were considered in selecting a conceptual preferred option for Woodroffe Avenue detour that would be required during construction.

Table 27: Woodroffe Detour Screening Criteria

WOODROFFE DETOUR SCREENING CRITERIA	(A) EAST	(B) WEST	(C) TRANSITWAY	(D) ROAD CLOSURE
Social Environment				
Impacts to sensitive receptors (e.g. residences, schools, churches)	🔴	🟡	🔴	🟡
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟠	🟠	🟡	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🔴	🟡	🟠	🟠
Impacts to Greenbelt Lands (e.g. fragmentation)	🟠	🟠	🔴	🟢
Impacts to infrastructure (e.g. major municipal infrastructure, private wells)	🟢	🟠	🟠	🟠
Natural Environment				
Impacts to natural environment features	🔴	🟡	🟡	🟡
Economic Environment				
Operating Costs	🟡	🟡	🟡	🟠
Construction Costs	🟠	🟡	🔴	🟠
Construction investment (e.g. length of construction time, complexity)	🟠	🟡	🟠	🟠
Physical Environment				
Geotechnical influences on construction (e.g. managing ground water)	🟡	🟡	🟡	🟢

Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

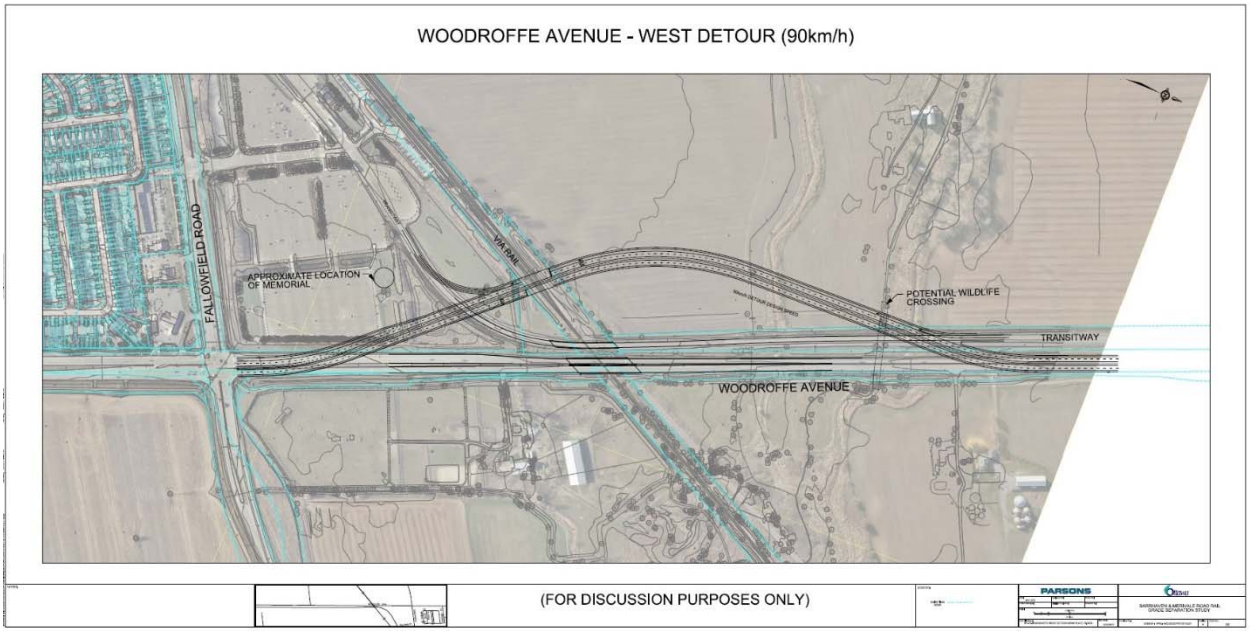
4.2.4 WOODROFFE PREFERRED OPTION

After reviewing the proposed options noted above a preferred option was further developed which consisted of providing an overpass for both Woodroffe Avenue and the Transitway as two separate structures.

The West detour option was selected as the preferred detour for further development during future design. A high level plan view of the West detour is shown below. North bound buses will need to be diverted for the duration of construction to use the VIA Park Place road to access Woodroffe northbound from the Fallowfield Road intersection. Detouring northbound bus traffic through the existing road network during the construction period may require additional transit priority measures at the intersections and rerouting cost to OC Transpo. OC Transpo operational planning staff would need to review and approve a rerouting option. Design consideration will be needed to review temporarily shortening the VIA siding track to avoid a two-track temporary at-grade crossing scenario. Also, operation and rail signal aspects will need to be considered to implement the new temporary crossing and crossing protection system.

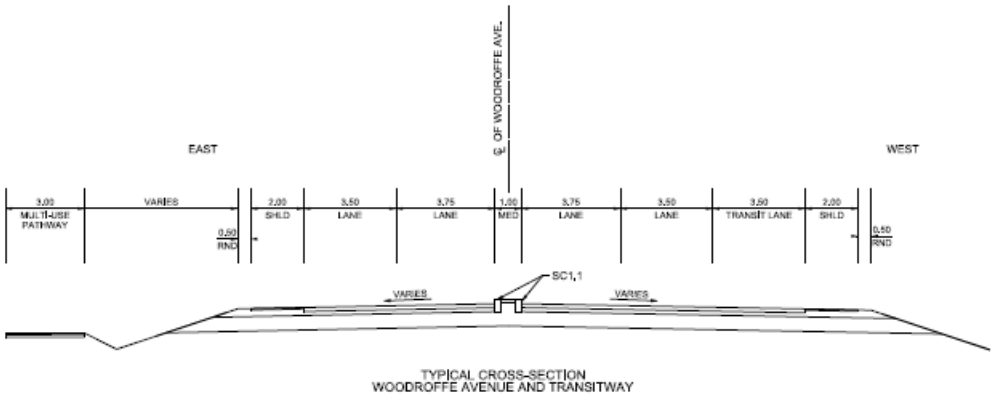
The circled area on the plan is the location of a memorial for the victims of the accident between the OC Transpo bus and VIA Rail train. It would not be impacted by the plan as shown but should be considered if alternate lane configurations or routes are explored.

Figure 57: Woodroffe Avenue Preferred Option with West Detour



Note: Refer to Appendix G for full size diagram

Figure 58: Proposed Woodroffe Avenue Cross Section



4.2.5 WOODROFFE/TRANSITWAY INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Woodroffe Avenue and Southwest Transitway at-grade crossing locations are listed below.

- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.
- Prior to the City taking any steps to move forward on construction of any rail grade separation crossing option on NCC and/or other federal lands, the NCC will require the City to engage an experienced and qualified environmental consultant to conduct a federal level environmental effects analysis that incorporates the environmental effects indicated within the Canadian Environmental Assessment Act (CEAA) in order for the NCC and any other federal authorities (VIA Rail, Fisheries and Oceans Canada, Environment and Climate Change Canada, etc.) to assess potential impacts and proposed mitigation measures, construction monitoring and follow-up studies.

4.2.6 WOODROFFE SUMMARY

Based on previous geotechnical studies performed by Golder the underpass option proposed in the original EA Study was deemed to be unsuitable due to costs for construction, ongoing operational costs, and potential risk to public safety. The preferred option for the Woodroffe Avenue crossing is to build an overpass over the existing rail crossing. The adjacent Transitway would also be an overpass using a separate structure. The vertical and horizontal geometry of the Transitway approach grades and structure will need to consider future LRT plans.

Options which involved a large scale raising or lowering of the rail were rejected as they will result in grade issues for the VIA station as well as significant interruptions to train service. Smaller grade adjustments to the rail elevation, +/- 30cm, should be explored at future design stages to optimize the vertical clearance at the bridge locations.

A road closure during the anticipated two to three year construction period was deemed to not be feasible as Woodroffe is a vital north south arterial connection. Consideration was given to using only two lanes instead of four for the temporary detour however based on traffic volume and demand the four lane configuration was maintained. The need for four lanes should be revisited as part of future design assignments to investigate the impacts to the local traffic network under a reduced capacity scenario. This would require the diversion of traffic to other routes and put pressure on the overall transportation network for the Barrhaven area. This review will also be dependent on other road works in the area at the time of construction.

There will be some impact to property and access specifically to the agricultural lands north of the railway line and at the Equestrian Center which will need to be handled during construction and later reinstated. Driveway access to Greenbelt properties is of particular concern to NCC and will need careful consideration during the construction period as well as to provide improved safety at driveways in the ultimate design. This could be achieved by including paved shoulder approaches and larger radius transitions to give space for users to safely transition in and out of the higher speed traffic lanes on Woodroffe. A site line review will also be required for any driveways that are within the approach grades to the new structure. The NCC have specifically requested that as part of the ultimate design a safer access should be provided to the Equestrian Center at 2069 Woodroffe Avenue as there have been many concerns raised about safety by people accessing this property. This project would be a good opportunity to make this access safer. The NCC has also requested that an access be provided to the heritage farm located at 2086 Woodroffe Avenue.

Barrier separation will be required on the overpass design to protect pedestrians and cyclists. NCC approvals will be required. Lightweight fill options will need to be explored to avoid excessive settlement of the overpass due to the poor soil conditions and high ground water table. Benefits of the overpass option are less drainage constraints, a reduced construction footprint, easier to construct, no rail detour required, no pump station required, and lower costs to operate.

There will be impacts to the cycling and pedestrian pathway. The existing 1220mm watermain will need to be protected during construction and may require realignment. Overhead utility lines will need to be relocated. The eventual design should also consider the potential for vehicles queuing into the detour at-grade crossing during construction.

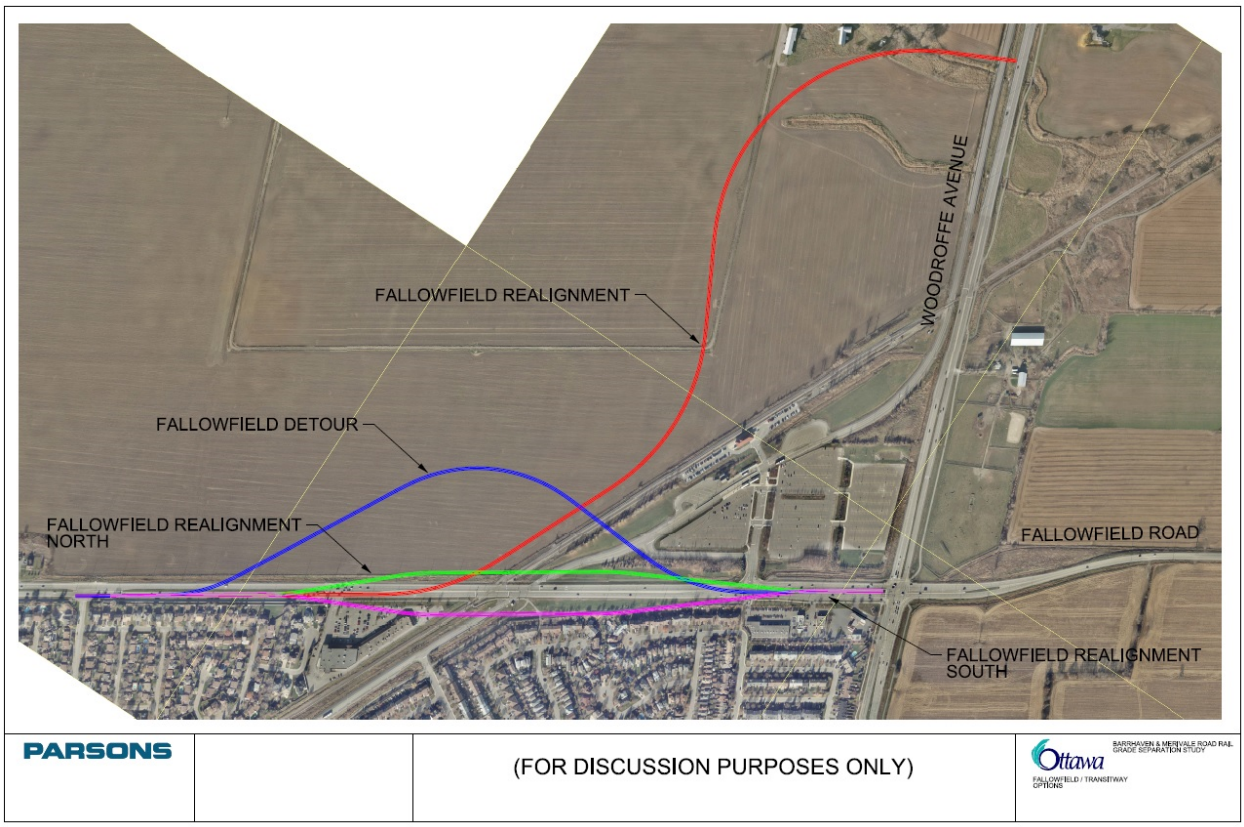
4.3 GRADE SEPARATION AT FALLOWFIELD ROAD

As noted previously the crossing exposure index for the Fallowfield crossing indicates that grade separation is warranted. Several options for grade separation were considered for the Fallowfield crossing. Additionally, two level crossing alternatives including the realignment of Fallowfield at the crossing, and closing Fallowfield at Woodroffe were also considered. All of the grade separation options and the level crossing alternatives at the Fallowfield crossing were reviewed and are highlighted in the sections that follow.

4.3.1 FALLOWFIELD CHALLENGES AND OPPORTUNITIES

Several options were considered for grade separation of Fallowfield Road as shown **Figure 59: Fallowfield Explored Options** and in **Table 28: Fallowfield Road Considered Options** below and as shown in Appendix C. Several detour options were also considered.

Figure 59: Fallowfield Explored Options



Note: Refer to Appendix G for full size diagram

Table 28: Fallowfield Road Considered Options

OPTION	CHALLENGES	OPPORTUNITIES
Overpass Road over rail	• Increased noise anticipated. Existing noise walls may need to be modified or a noise wall added at the structure. • Creates changes to rear yard views from residential area.	• Improved crossing safety to separate road and rail traffic. • No road or multi-use pathway detour required for permanent road realignment option.

	• Transitway and Park and Ride modifications required. • Disruption to agriculture activities. • Impacts to Greenbelt lands, high quality farmed fields with existing tile drains. • Significant excavation and dewatering. • Geotechnical conditions are not ideal for an overpass; light weight fill required. • Likely need to build multi span structure to cross rail tracks and Transitway. • Access disruptions to adjacent property and businesses. • Transit services disruptions during construction. • Construction dewatering and potential contamination. • Overhead utilities would need to be relocated. • Potential Impacts to deep municipal infrastructure.	• Minimal impact to current traffic lanes during construction. • Opportunity to create views and vistas of Greenbelt land. • No rail detour required; limited to no impacts to VIA Station operation. • Reduced impacts to Transitway operations during construction. • Surface drainage is easier to manage as water can naturally drain with the positive road grade. • Lower construction and operating cost than underpass option. • Opportunity for direct pathway connection to Transit and VIA Stations.
Underpass Road Under Rail	• Challenging drainage requiring pumping stations, sumps, and stormwater management facilities such as a retention pond. • Requires large excavation. • Geotechnical conditions are not ideal. • Disruptions / detours required for road and existing multi-use pathway during construction. • Rail detour required during construction. Temporary at-grade crossing may not be feasible due to operational and railway signal constraints. • Challenging drainage issue requires pump station and stormwater management facilities such as a retention pond or roadside ditch to manage water quantity and quality issues. • Impacts to deep municipal infrastructure; relocation of 762mm watermain required. • Underpass was the preferred option in the previous EA however geotechnical investigations after the EA revealed extensive geotechnical and drainage issues. • Hydrological issues would require extensive bedrock grouting to control groundwater. • Pumping capacity requirements present a high risk of flooding. • Would require a larger footprint for underpass excavations and stormwater treatment facility.	• Improved crossing safety to separate road and rail traffic. • Opportunity to improve drainage in the area if a stormwater facility is included. • Reduced impact to rear yard views from adjacent residential. • Opportunity to improve the corridor. • Opportunity to improve driveway access to adjacent properties. • Lower noise and vibration impacts.

	• No pathway connection opportunity to stations.	
Combination Raise Rail and Lower Road	• Road detour required during construction. • Rail detour required during construction. Temporary at-grade crossing may not be feasible due to operational and railway signal constraints. • Disruptions / detours required for cyclists and pedestrians. • Impacts a larger footprint. • Expensive. • Property and Transitway impacts adjacent to rail tracks. • Pump station and stormwater management facilities required. • Impacts to deep municipal infrastructure. • Pumping capacity requirements present a high risk of flooding. • Impacts to Greenbelt lands. • Potential need for lightweight fill over sensitive soils. • Complex staging for combined Fallowfield and Transitway construction, as well as Train operations and schedule. • Impacts to train safety (grade issues with nearby station). • Reconstruction of VIA platform and station elements required.	• Geotechnical related risks and costs lower due to reduced depth of fill or excavation. • Reduced noise impacts. • Balanced impact to railway and roadway. • Potential to create a new pathway connection under new structure. • Road drainage easier to handle as it can be conveyed in a gravity storm sewer system. • Improved crossing safety to separate road and rail traffic.
Realign Fallowfield to Woodroffe Close existing crossing	• Disruption to transit connectivity. • Disruption to critical arterial east-west movements. • Challenges to connect to Woodroffe; New intersections at the Transitway and Woodroffe would be too close together and is not recommended. • Disruption to access for adjacent businesses. • Disruption to agricultural activity. • Permanent large scale impact to Greenbelt lands. • Access to farms and businesses severed. • Impact to Black Rapids Creek corridor (NCC natural link / EP zoned lands).	• Reduced construction period and costs. • Removal of one at-grade rail crossing reduces risk. • Removal of Fallowfield/Transitway intersection. • Opportunity for unobstructed pathway connection to the Transit and VIA stations.
In place construction – split span (i.e. build one direction of the road at a time)	• Maintain two lanes of traffic within the existing four lane cross section could not handle volume/capacity requirements. • Requires complex rerouting of train and Transitway operation. • Requires extensive retaining wall structures to construct embankments directly adjacent to traffic.	• Reduced construction footprint. • No need for temporary detour.

Detour option with an overpass at existing crossing	• Increased noise with overpass on existing Fallowfield road alignment. • Potential impacts to safety at new temporary at-grade crossing. • Impacts to visibility if crossing is less than 90 degrees. • Difficult connections to Transitway and Park and Ride. • New traffic signals and at-grade warning system interconnect at temporary Transitway/ detour intersection. • Would require creative solutions to accommodate cyclists. • Impacts to the VIA Rail station platform and siding track. • Disruption to agriculture activities. • Requires significant excavation and road base fill. • Additional costs for detour. • Geotechnical constraints from soils. • More complex structural requirements.	• No permanent impacts to NCC farm lands. • Straight permanent road alignment on Fallowfield, no horizontal curves required. • Reduced impact to existing intersections.
Overpass with Realignment of Fallowfield 40m North - No Detour	• Increased noise. • Impacts to visibility due to new horizontal and vertical curves in road. • Changes in rear yard views. • Permanent impact to agricultural lands requires equivalent land compensation to NCC (no net loss). • Geotechnical constraints from soils • More complex structural requirements.	• Provides additional green space that can be used to create park land for context sensitive landscaping buffer. • Reduced costs during construction. • Fewer impacts to commuters during construction. • Reduced disruption to agriculture activities during construction. • Opportunity to create additional green space south of the new alignment, reinstate old road bed. • Permanent road realignment would create better separation from existing residential sensitive receivers.
Overpass with South Realignment	• Would involve many property acquisitions of residences and a mall. • Significant impact to local community. • Increased costs. • Overpass in back yards	• Protects NCC farm land within the Greenbelt.

4.3.2 FALLOWFIELD GRADE SEPARATION SCREENING CRITERIA

The **Table 29: Fallowfield Screening Criteria** below illustrates the evaluation criteria and options that were considered.

Table 29: Fallowfield Screening Criteria

FALLOWFIELD SCREENING CRITERIA	(A) **Overpass** Road over Rail	(B) **Underpass** Road Under Rail	(C) **Combination** Raise Rail and Lower Road
Social Environment			
Impacts to sensitive receptors (e.g. residences, schools, churches)	🟠	🟡	🔴
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟡	🟠	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🟢	🟠	🟠
Impacts to Greenbelt Lands (e.g. fragmentation)	🟠	🟠	🟠
Impacts to infrastructure (e.g. major municipal infrastructure, private wells)	🟠	🟠	🔴
Natural Environment			
Impacts to natural environment features	🟢	🟢	🟢
Economic Environment			
Operating Costs	🟡	🔴	🔴
Construction Costs	🟠	🔴	🔴
Construction investment (e.g. length of construction time, complexity)	🟠	🔴	🔴
Physical Environment			
Geotechnical influences on construction (e.g. managing ground water)	🟠	🔴	🟠

Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.3.3 FALLOWFIELD DETOUR OPTIONS SCREENING CRITERIA MATRIX

The **Table 30: Fallowfield Detour Screening Criteria** below illustrates the evaluation criteria and options that were considered.

Table 30: Fallowfield Detour Screening Criteria

FALLOWFIELD DETOUR OPTIONS SCREENING CRITERIA	(A) Realign Fallowfield to Woodroffe Close Existing Crossing	(B) Split Span In-place construction	(C) Detour Option with an Overpass	(D) Realignment 40m North with Overpass	(E) Realignment 40m South with Overpass
Social Environment					
Impacts to sensitive receptors (e.g. residences, schools, churches)	🟠	🟠	🟠	🟡	🔴
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🔴	🔴	🟠	🟡	🟡
Impacts to existing land use (e.g. access to businesses, displacement)	🔴	🟡	🟠	🟡	🔴
Impacts to Greenbelt Lands (e.g. fragmentation)	🔴	🟡	🟠	🟠	🟢
Impacts to infrastructure (e.g. major municipal infrastructure, private wells)	🟠	🟠	🟠	🟠	🟠
Natural Environment					
Impacts to natural environment features	🟠	🟢	🟢	🟢	🟢
Economic Environment					
Operating Costs	🟢	🟡	🟡	🟡	🟡
Construction Costs	🟠	🟠	🟠	🟠	🔴
Construction investment (e.g. length of construction time, complexity)	🟠	🔴	🟠	🟠	🔴
Physical Environment					
Geotechnical influences on construction (e.g. managing ground water)	🟠	🟠	🟠	🟠	🟠

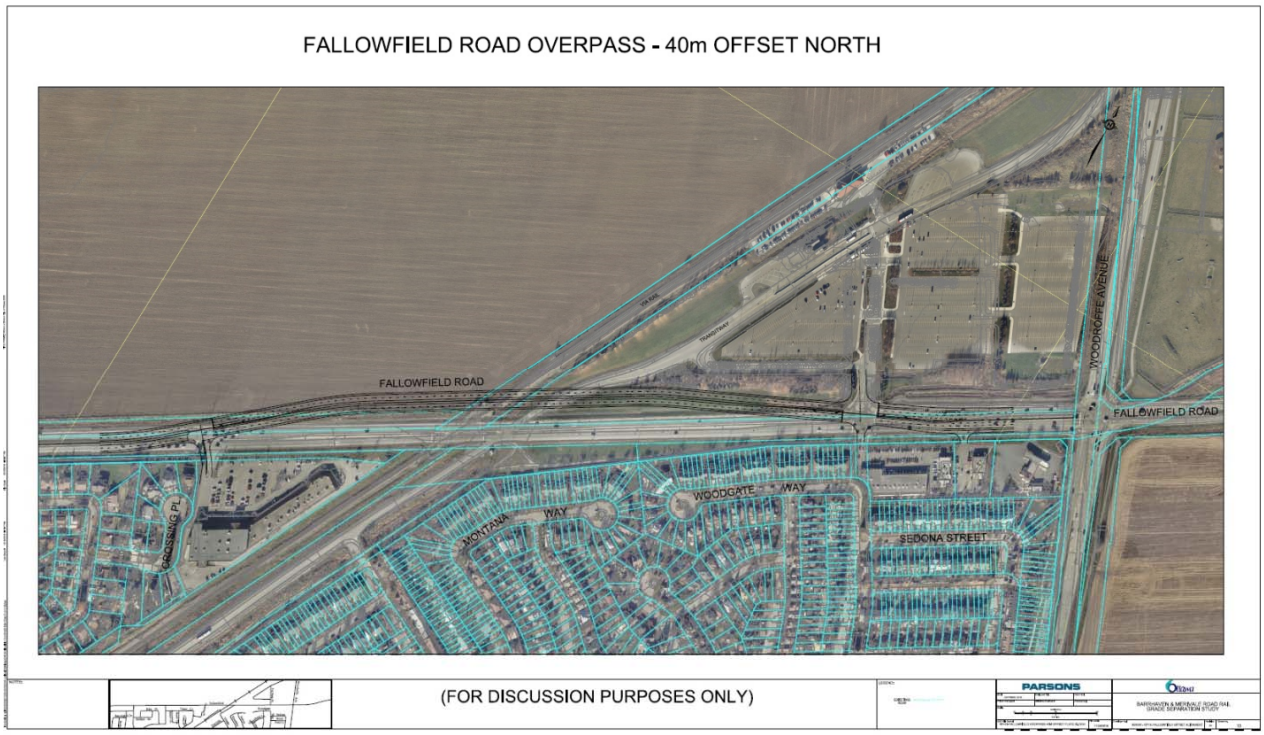
Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.3.4 FALLOWFIELD PREFERRED OPTION

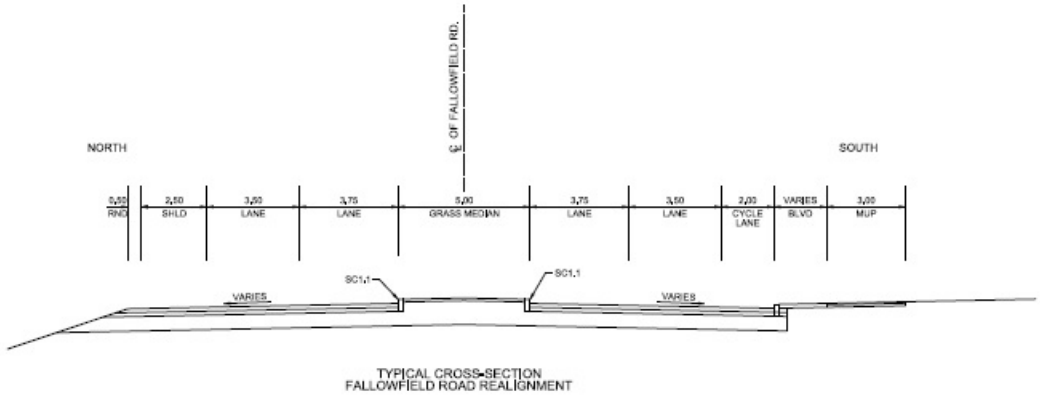
The preferred option for Fallowfield Road is to realign Fallowfield Road approximately 40m north of the current crossing with an overpass going above the railway and OC Transpo corridor. This will allow for significant cost savings compared to doing a temporary detour as well as a smaller environmental impact. The preferred option is shown below in Figure 60: Fallowfield Road Preferred Option.

Figure 60: Fallowfield Road Preferred Option



Note: Refer to Appendix G for full size diagram

Figure 61: Fallowfield Proposed Cross Section



4.3.5 FALLOWFIELD INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Fallowfield Road at-grade crossing location are listed below.

- Careful site plan control and/or restrictions to adjacent development that may infringe on the required property and access needs for a grade separation solution.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.
- Prior to the City taking any steps to move forward on construction of any rail grade separation crossing option on NCC and/or other federal lands, the NCC will require the City to engage an experienced and qualified environmental consultant to conduct a federal level environmental effects analysis that incorporates the environmental effects indicated within the Canadian Environmental Assessment Act (CEAA) in order for the NCC and any other federal authorities (VIA Rail, Fisheries and Oceans Canada, Environment and Climate Change Canada, etc.) to assess potential impacts and proposed mitigation measures, construction monitoring and follow-up studies.

4.3.6 FALLOWFIELD SUMMARY

The preferred option for the Fallowfield Road crossing is an overpass which will grade separate the road over the existing rail line and Transitway. It is recommended that the grade separation structure be built in a permanently realigned location approximately 40m north of the current road alignment in order to create greater separation from the existing residential neighborhood and to avoid costly temporary detour road construction. The overpass would likely be constructed as a multi span structure, one span to bridge over the rail line and the second over the Transitway. The multi span design would reduce the bridge deck depth which will translate into a lower overall structure height and reduced costs. Design of the Transitway span should consider future LRT clearance requirements.

Both Transitway buses and VIA trains can remain fully operational during the construction period using the overpass scenario.

Options which involved a large scale raising or lowering of the rail were rejected as they will result in grade issues for the VIA station as well as significant interruptions to train service. Smaller grade adjustments to the rail elevation, +/- 30cm, should be explored at future design stages to optimize the vertical clearance at the bridge location.

There will be impacts to property. Mainly related to federal land use of NCC controlled prime agricultural lands (class 2 with tile drains). Access modifications to businesses south of the road and the Park and Ride will be required.

Consideration was given to using only two lanes and constructing the road in place as a split span (i.e. constructing one direction of the road at a time) temporary detour however based on traffic volume and demand this was not deemed feasible. Barrier separation will be required on the overpass design to protect pedestrians and cyclists.

Based on several geotechnical studies performed by Golder the underpass option was deemed to be unsuitable due to costs for construction, storm water management facility requirements, and potential risks to public safety. Lightweight fill may be required to provide a better base for the overpass due to poor soils and high water table. Benefits of the overpass option are less drainage constraints, a reduced construction footprint, easier to construct,

and lower costs to operate. It will also have a minimal impact to traffic during construction. There will be impacts to the multi-use pathway during construction.

The NCC has confirmed that a Federal Environmental Effects Analysis report and FLUTDA approvals will be required. The NCC has noted that impacts to NCC lands should be avoided or at least minimized. NCC staff have indicated an initial preference towards a temporary detour road solution as opposed to a road realignment that would require a permanent land impact.

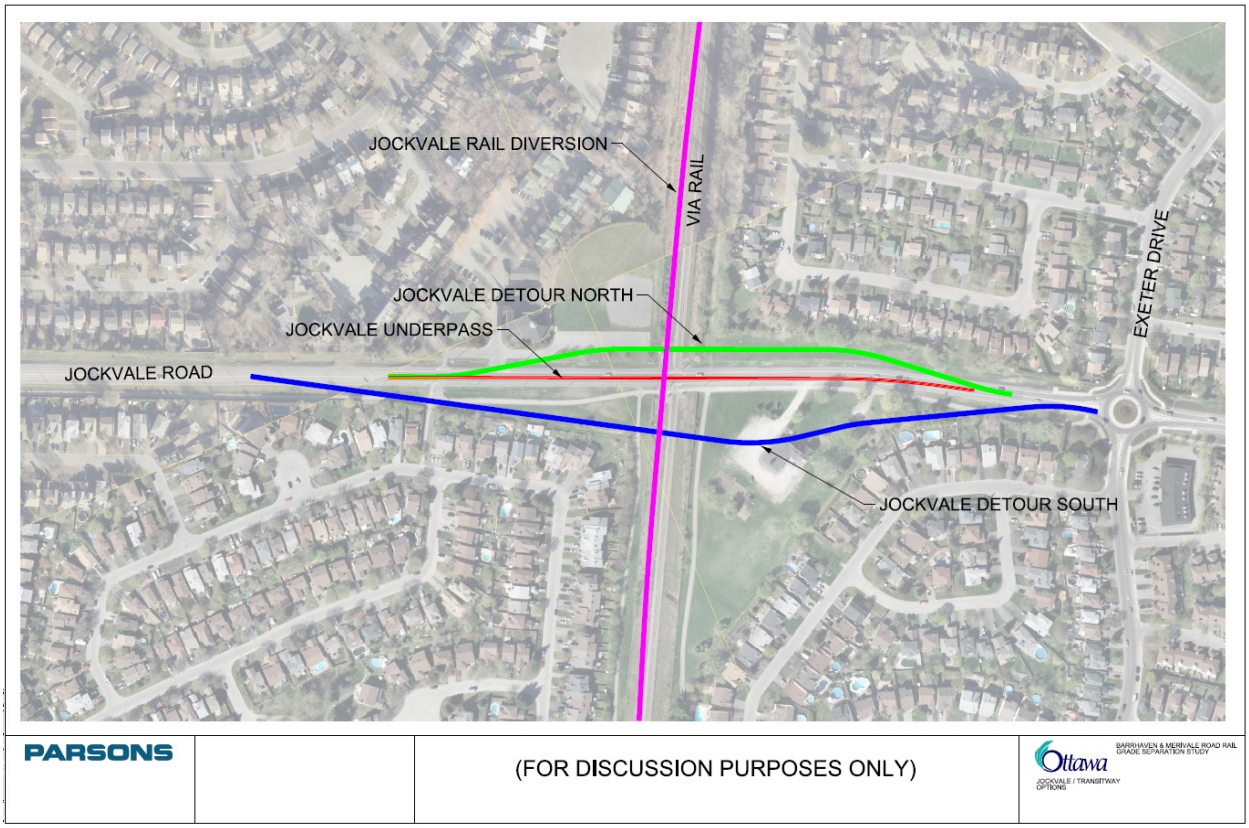
4.4 GRADE SEPARATION AT JOCKVALE ROAD

Although no EA has been completed for the Jockvale Road crossing the crossing exposure index for Jockvale Road indicates that grade separation will be warranted in the foreseeable future. Various options for grade separating at the Jockvale Road crossing were reviewed and are highlighted in the sections that follow. It should also be noted that no geotechnical information was available for this location so some assumptions were made that geotechnical conditions would be similar to the Greenbank Road grade separation currently underway.

4.4.1 JOCKVALE CHALLENGES AND OPPORTUNITIES

Based on future conditions on Jockvale Road a grade separation will be warranted and as such several options for grade separation were considered for further development. Reviewed options for Jockvale Road are shown in **Figure 62: Jockvale Explored Options** and in **Table 31: Jockvale Road Considered Options**.

Figure 62: Jockvale Explored Options



Note: Refer to Appendix G for full size diagram

Table 31: Jockvale Road Considered Options

OPTION	CHALLENGES	OPPORTUNITIES
Overpass Road over rail	• Highly constrained road corridor with limited opportunity for embankment fills without substantial land acquisitions.	• Improved crossing safety to separate road and rail traffic.

	• Increased noise anticipated. Noise wall may be needed on the structure and temporary wall may be required during construction. • Creates changes to views for nearby residential area. • Geotechnical conditions unknown. • Access to church is impacted. May require new access from Townsend Drive, right in/right out only at Jockvale, and parking lot modifications. • Requires larger footprint • Significant utility relocations required.	• Opportunity to connect north and south MUP beneath the overpass • Surface drainage is easier to deal with than underpass. • No rail detour required. • Lower construction and long term operating cost than underpass.
Underpass Road Under Rail	• Potential ground water conditions need to be assessed. • Challenging drainage may requiring pumping stations, sumps, and storm water management facilities such as a retention pond. • Requires large excavation. • Geotechnical conditions unknown. • Access to church is impacted. May require new access from Townsend Drive, right in/right out only, and parking lot modifications. • Significant utility relocations would be required. • Temporary rail diversion / detour required	• Improved crossing safety to separate road and rail traffic. • Opportunity to connect north and south MUP via a separate pedestrian bridge structure. • Reduced impact to rear yard views from adjacent residential. • Lower noise impacts.
Combined Raise rail and lower road	• Impacts a larger footprint • Property impacts adjacent to rail tracks • Detour for trains during construction • Staging difficulty (maintain train schedules) • Very costly to create a rail detour. • Significant utility relocations would be required. • Road and Rail detour required during construction. • Disruptions / detours required for cyclists and pedestrians. • Impacts a larger footprint. • Expensive. • Property impacts adjacent to rail tracks. • Geotechnical conditions unknown. • Pump station and stormwater management facilities required. • Impacts to rear yard views. • Impacts to train operations.	• Geotechnical related risks and costs lower due to reduced depth of fill or excavation. • Reduced road noise impacts. • Balanced impact to railway and roadway. • Potential to create new pathway connections under new structure. • Road drainage easier to handle as it can be conveyed in a gravity storm sewer system. • Improved crossing safety to separate road and rail traffic.
South Detour	• Church lands would need to be acquired or building would need to be relocated prior to construction.	• No impacts to ball field and parking lot.

	• Impacts to active transportation modes. • Significant property impacts. • Access to church is impacted and may need to be diverted to Townsend Drive.	
North Detour	• Driveway modifications and parking lot relocation required prior to construction • Impacts to active transportation modes • Significant land/property impacts • Access to church is impacted and may need to be diverted to Townsend Drive • Impact to baseball field. • Potential sight line issues exist which may require temporary property to address. Sight lines to be maintained as per the regulations.	• No relocation of church building and access required. • Reduced impact to existing pathways.
Close Road during construction	• Impacts to transit and commuters • Impacts to a few accesses such as the churches. • Impacts to active transportation • Community concerns with loss of direct route (additional costs to residents) • Transit rerouting required.	• Would allow for faster and less costly construction. • Reduced risk.

One option that was not considered in this report was a permanent closure of Jockvale Road to motorized traffic and a grade separation only for pedestrians and cyclists. This could be reviewed as part of a future EA but was not examined here due to the impact on transit and general traffic flows.

4.4.2 JOCKVALE GRADE SEPARATION SCREENING CRITERIA

The **Table 32: Jockvale Screening Criteria** below illustrates the evaluation criteria and options that were considered in selecting a preferred option for Jockvale Road.

Table 32: Jockvale Screening Criteria

JOCKVALE SCREENING CRITERIA	(A) **Overpass** Road over rail	(B) **Underpass** Road Under Rail	(C) **Combination** Raise Rail and Lower Road
Social Environment			
Impacts to sensitive receptors (e.g. residences, schools, churches)	🔴	🟡	🔴
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟠	🟡	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🟠	🟡	🟠
Impacts to Greenbelt Lands (e.g. fragmentation)	🟢	🟢	🟢
Impacts to infrastructure (e.g. major municipal infrastructure)	🟠	🟠	🟠
Natural Environment			
Impacts to natural environment features	🟢	🟢	🟢
Economic Environment			
Operating Costs	🟡	🟠	🟠
Construction Costs	🟠	🟠	🔴
Construction investment (e.g. length of construction time, complexity)	🟠	🟠	🔴
Physical Environment			
Geotechnical influences on construction (e.g. managing ground water)	🟠	🟠	🟠

Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.4.3 JOCKVALE DETOUR SCREENING CRITERIA

The evaluation criteria and options that were considered in selecting a preferred option for the Jockvale construction detour are shown in Table 33.

Table 33: Jockvale Detour Screening Criteria

JOCKVALE DETOUR SCREENING CRITERIA	(A) South Detour	(B) North Detour	(C) Close Road
Social Environment			
Impacts to sensitive receptors (e.g. residences, schools, churches)	🔴	🟡	🔴
Impacts to transportation network (e.g. disruption to the continuity, does not meet intended purpose for vehicles, pedestrians, cyclists)	🟠	🟡	🔴
Impacts to existing land use (e.g. access to businesses, displacement)	🟠	🟡	🟢
Impacts to Greenbelt Lands (e.g. fragmentation)	🟢	🟢	🟢
Impacts to infrastructure (e.g. major municipal infrastructure)	🟠	🟠	🟡
Natural Environment			
Impacts to natural environment features	🟢	🟢	🟢
Economic Environment			
Operating Costs	🟢	🟢	🟢
Construction Costs	🟠	🟠	🟢
Construction investment (e.g. length of construction time, complexity)	🔴	🟠	🟢
Physical Environment			
Geotechnical influences on construction (e.g. managing ground water)	🟠	🟠	🟡

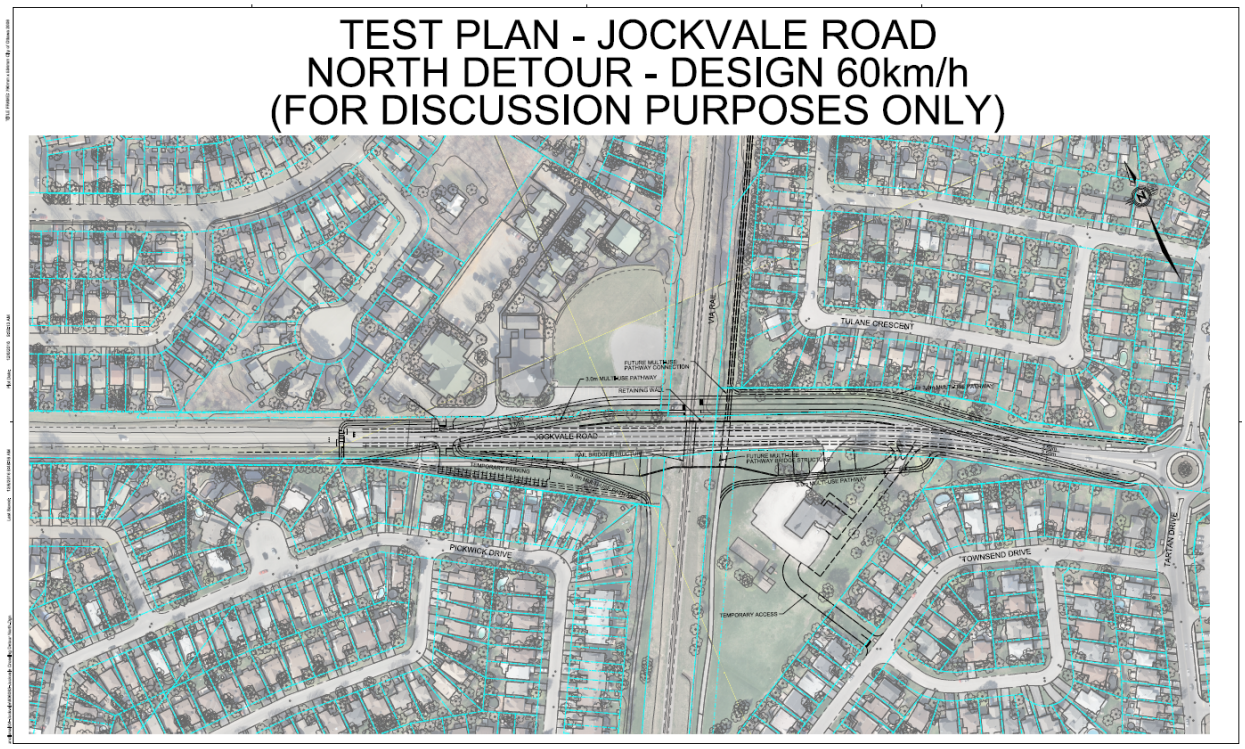
Legend:

- 🟢 No impacts or positive outcome
- 🟡 No major foreseen impacts; minor mitigation required
- 🟠 Major impacts; several mitigation measures required
- 🔴 Severe impacts; extensive mitigation required

4.4.4 JOCKVALE PREFERRED OPTION

The preferred option for Jockvale Road shown in **Figure 63: Jockvale Road North Detour** is an underpass (Option A from **Table 32**) with the South detour (Option B from **Table 33**) configuration during construction. For a larger drawing refer to Appendix D. Note that with further geotechnical information this recommendation may need to be revisited but a similar decision was made at the Greenbank Road crossing which is in close proximity to the Jockvale Road location. For this study it has been assumed that the Jockvale crossing will have similar subsurface soils, groundwater, and bedrock conditions as the Greenbank Road grade separation.

Figure 63: Jockvale Road North Detour



Note: Refer to Appendix G for full size diagram

Other options that were considered for construction were a South detour and closing of Jockvale Road at the VIA Rail crossing.

The South Detour option shown in **Figure 64: Jockvale Road South Detour Option** illustrates a potential detour to the south during construction. This detour runs through the current location of the church building and as such is not likely to be considered.

The final option was to close Jockvale Road during construction. While closing the road does have many benefits to construction timing and costs, it has a significant impact to residents and commuters that use this section of Jockvale Road and is likely to receive opposition from local residents. A full closure should be explored further during the future EA study and presented to the public for feedback before ruling it out.

During construction, it is also recommended that site access be from one side only. The nearby Greenbank project restricted access during construction to be from the south-bound direction with right-in and right-out (RIRO) access to the detour road which proved to be successful. The relocated parking from the church should also be considered for a potential RIRO requirement.

Figure 64: Jockvale Road South Detour Option

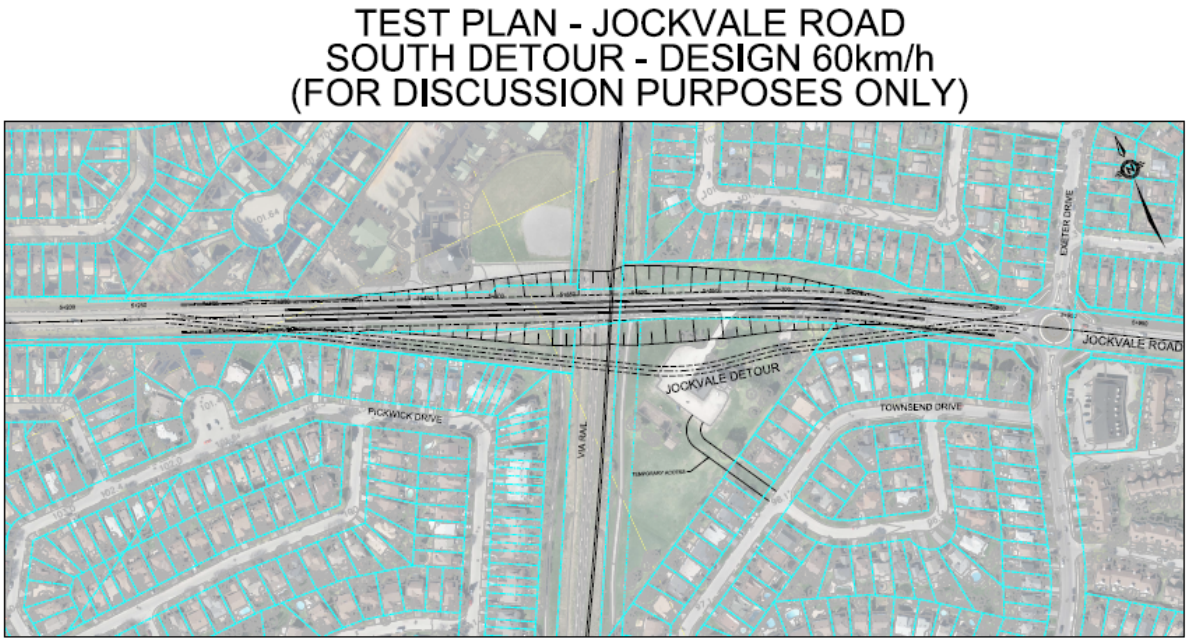
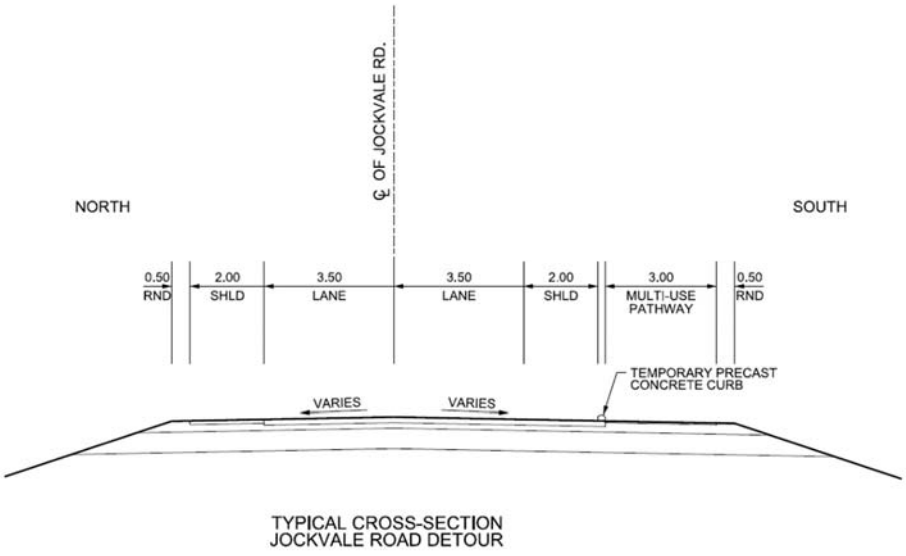


Figure 65: Typical Jockvale Section



4.4.5 JOCKVALE INTERIM MEASURES

Interim safety and site improvement measures that should be considered at the Jockvale at-grade crossing location are listed below.

- Careful site plan control and/or restrictions to adjacent development that may infringe on the required property and access needs for a grade separation solution.
- Conduct a site specific Municipal Class EA.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.

4.4.6 JOCKVALE ADDITIONAL CONSIDERATIONS

Before construction of the underpass begins the City of Ottawa is considering improvements to cycling and pedestrian connections in the vicinity of the Jockvale Road at-grade crossing. This needs to be considered as it may impact the location for the rail diversion track. Extensions to the pathways could include a mid-block crossing of Jockvale Road to connect to the existing pathways on the east and west sides of Jockvale. An asphalt multi-use pathway exists on the west side of Jockvale with a separate dedicated railway crossing protection system. There is no sidewalk or formal pathway connection on the east side of the road in the study area. An informal trail connection exists on the east side that runs parallel to the tracks.

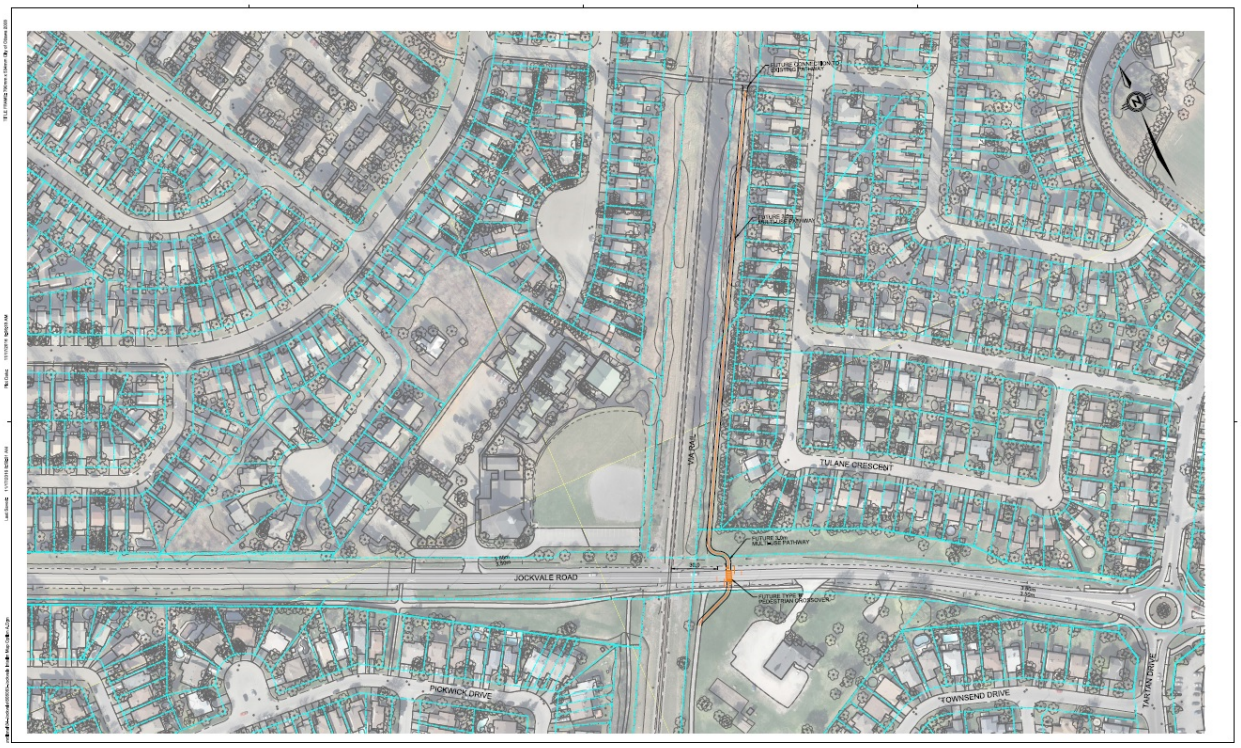
The following options are provided for further discussion and review related to the mid-block crossing review. The photo below illustrates the current condition of the informal pathway connection as of the time of writing of this report. Pedestrians currently use the existing gravel shoulder which is not preferred.

Figure 66: Current Pathway North of Jockvale Along Railway

4.4.6.1 Option A – Mid-Block Crossing 30m South of the At-grade Crossing

This option includes a formal extension of the existing MUP north of Jockvale to a controlled mid-block crossing located approximately 30m south-east of the VIA Rail crossing. This is an ideal connection point for users trying to access the MUP on the opposite side of Jockvale, running parallel with the tracks within an easement on the church property. It would provide a more efficient route for cyclists and pedestrians however this option is not recommended due to its very close proximity to the grade crossing and greater potential for south bound traffic to queue over the crossing.

Figure 67: Interim MUP Connection - Option A

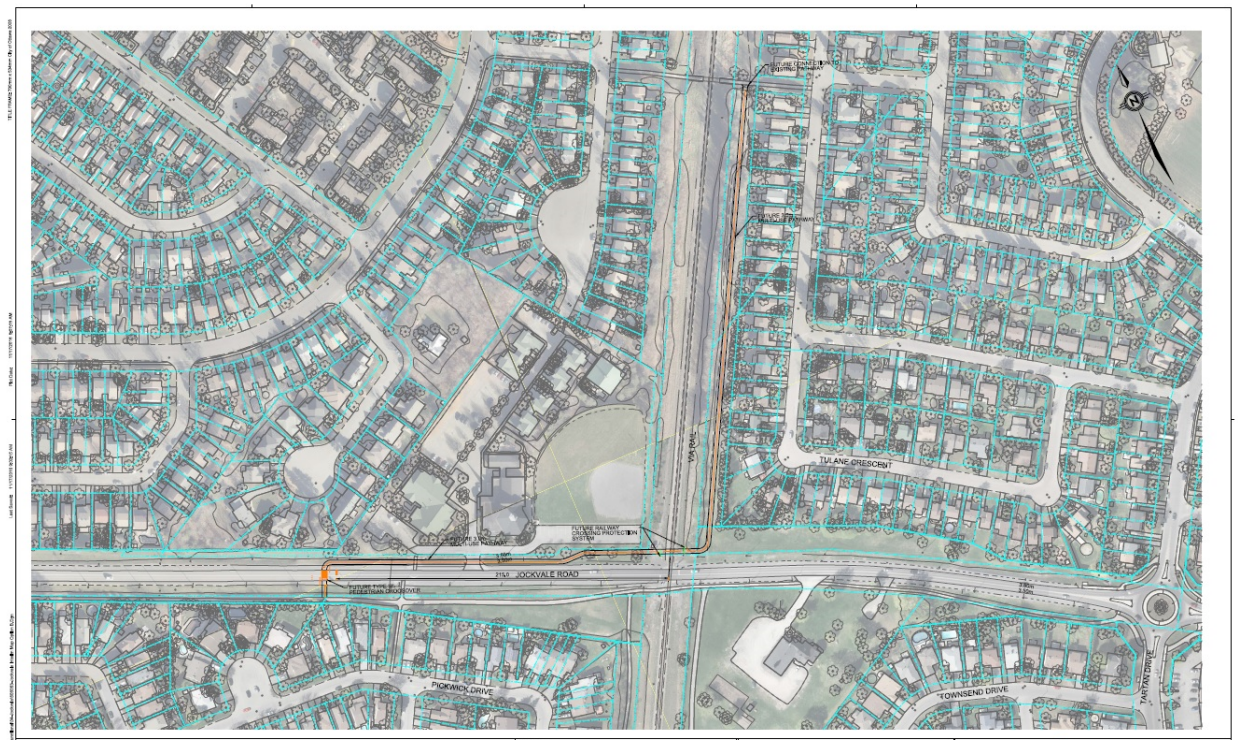


Because of the proximity of the crosswalk to the grade crossing the use of a Pedestrian Cross Over (PXO) might not be appropriate and a solution may require the use of a standard pedestrian signal crossing to ensure minimum green times between signal activations to clear queues. The City may also need to consider the need for a School Crossing Guard at the pedestrian crosswalk.

4.4.6.2 Option B – Mid-Block Crossing 215m West of At-grade Crossing

According to OTM Book 12 guidelines the minimum separation between signalized intersections is 215m. Option B demonstrates the location of a potential future PXO 215m to the west of the rail crossing. This option provides greater separation to accommodate north bound vehicular queues.

Figure 68: Interim MUP Connection - Option B

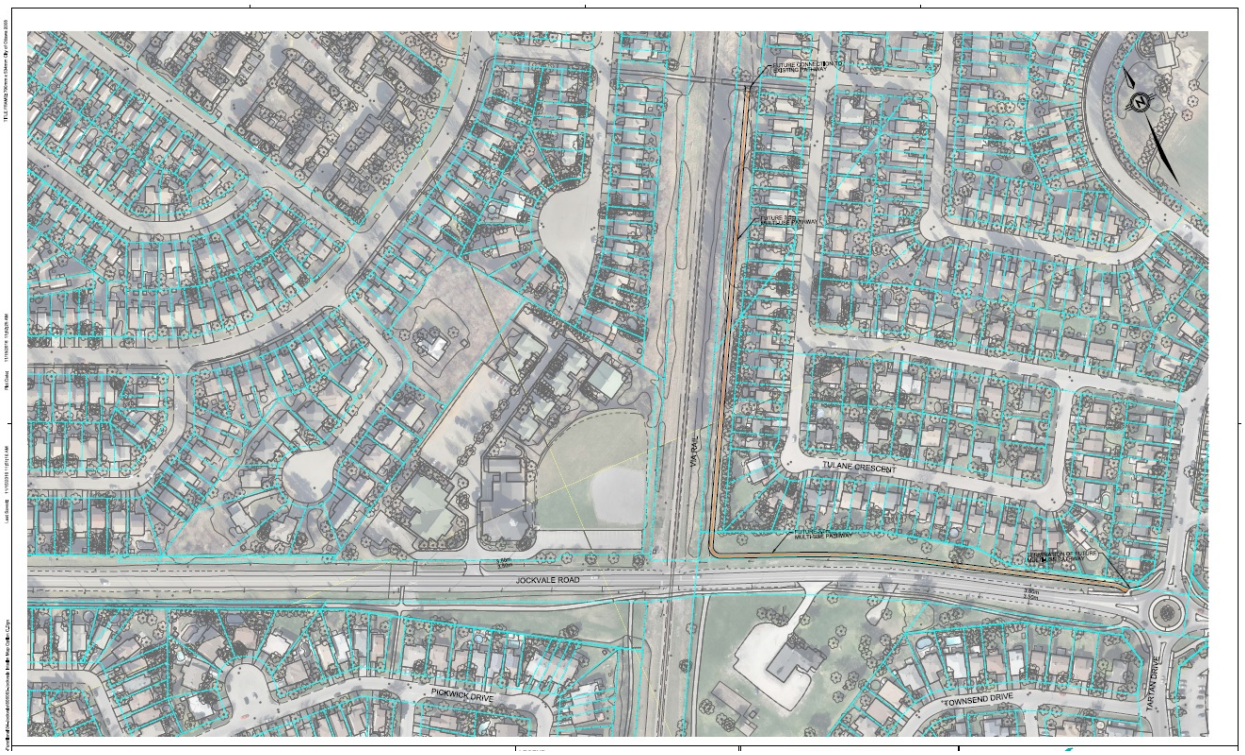


The use of a PXO for option B may not be appropriate and consideration of the use of standard pedestrian signal to ensure minimum green times between the signal activation to clear north bound queues that may encroach on the grade crossing is recommended.

4.4.6.3 Option C – Connecting the MUP to the Roundabout at Tartan Drive

Another alternative for consideration is to connect the MUP to the nearby roundabout intersection at Tartan Drive as illustrated below.

Figure 69: Interim MUP Connection - Option C



4.4.6.4 Option D– Combination of Option B and C

Option D illustrates a method of addressing many of the concerns of prior options by a combination of Option B and Option C as shown below in **Figure 70: Interim MUP Connection - Option B and Option C Combined.**

Figure 70: Interim MUP Connection - Option B and Option C Combined

This combined option allows for full connectivity to the existing sidewalk and pathway network. However this option does come at the added expense to add an additional at-grade (pedestrian and cyclist) crossing warning system at the rail line and a mid-block traffic signal or PXO style crossing.

4.4.7 JOCKVALE SUMMARY

Unlike the other crossings, an Environmental Assessment has not been prepared for the Jockvale study area. However, based on projected AADT and VIA train numbers there is justification for providing grade separation at the Jockvale Road crossing and a Municipal Class EA would be warranted. Prior to any work being undertaken a detailed Geotechnical study should be conducted to confirm water and soil conditions. Both during and after construction there will be impacts to the access of the Barrhaven Fellowship Christian Reform Church. A preferred alternate access is shown in **Figure 71: Possible Entrance Relocation for Church.** Various options also exist for connecting the north and south multi-use pathways that parallel the rail line. If an underpass option is constructed then consideration could be given to provision of a separate pedestrian bridge over the underpass and adjacent to the rail bridge to provide a direct pathway to connect the MUPs and discourage use of the rail bridge.

Figure 71: Possible Entrance Relocation for Church

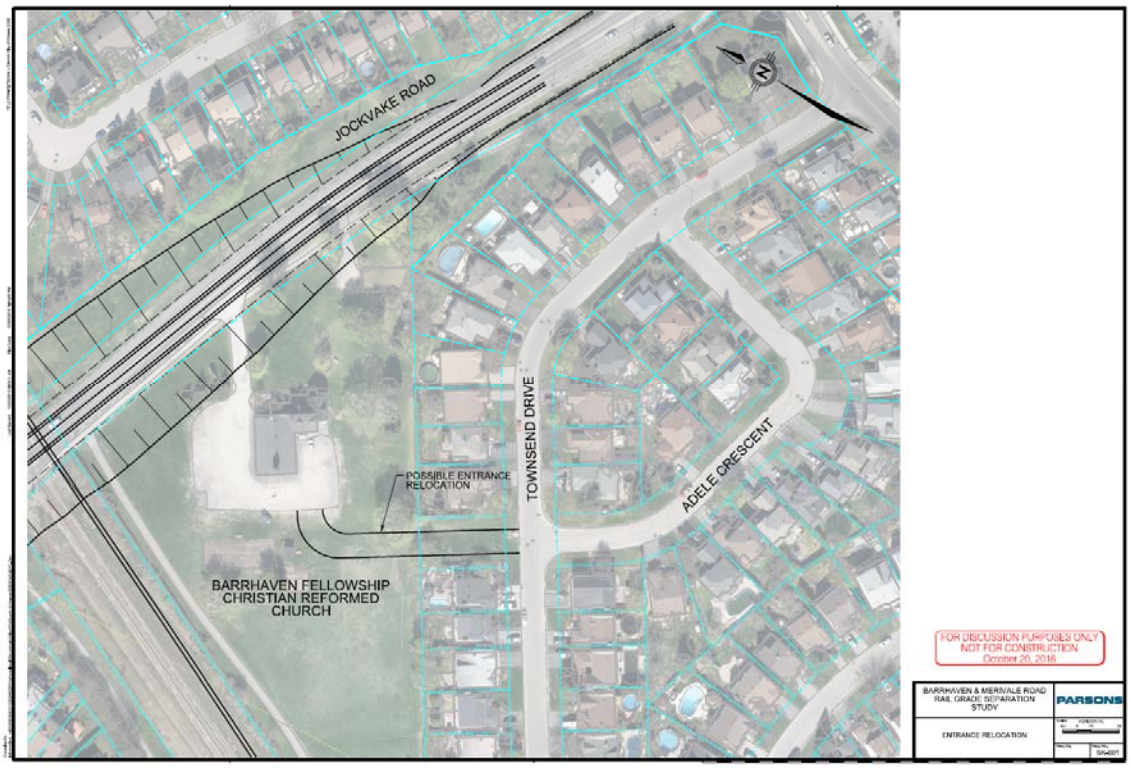


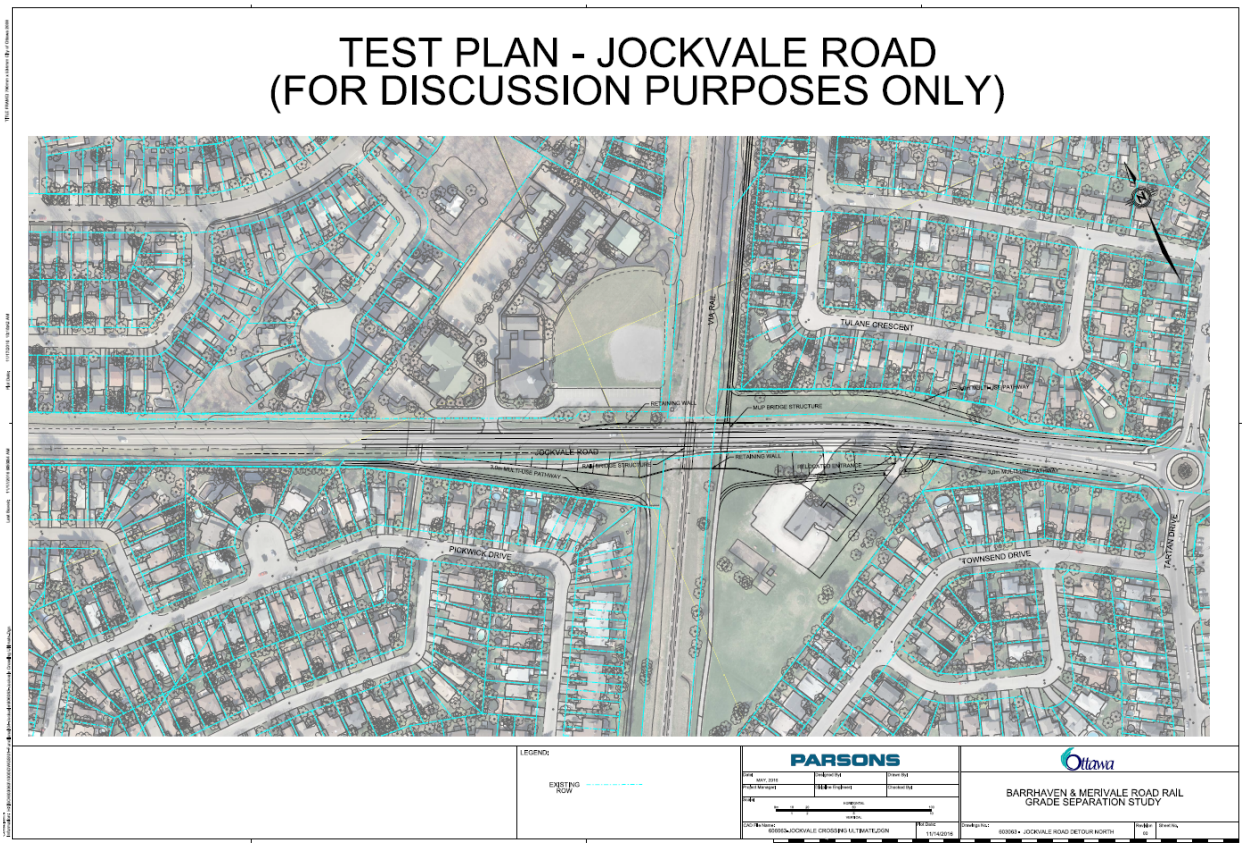
Figure 72: Extended Fence at 24 Townsend Drive

The City has confirmed that in May 2014 the City granted a 5-year License of Occupation Agreement to the homeowners of 29 Townsend Drive, to use part of the adjacent City lands for the purpose of an extended side yard as shown in **Figure 72: Extended Fence at 24 Townsend Dr**. The License can be terminated on 60-days' notice in writing. Future EA studies should consider the full 18.2m width of this block of land to thus be available.

4.4.7.1 Jockvale Ultimate Plan

The ultimate proposed plan is illustrated in **Figure 73: Jockvale Ultimate Plan** below showing a grade separation (road under rail). For a larger image refer to Appendix D. Some challenges with this include additional cost for a pedestrian bridge to connect the east-west MUP; the right-in and right-out location for the church driveway; the south west MUP will likely require an easement or property acquisition to allow placement in the depicted location; and a location for storm water pond or other facilities to manage potential ground water and drainage issues due to the underpass.

Figure 73: Jockvale Ultimate Plan



5.0 COST REVIEW

5.1 COST ESTIMATES

A high level, Class D, review/revisit of the cost estimates to implement the grade separation projects is presented below. Cost summary sheet breakdowns are presented in Appendix E.

The estimates are based on the following list of assumptions.

- Unit prices based on 2016 City of Ottawa Spec Code Listing and/or recent contract values based on projects with similar size and scope.
- The overall project costs are heavily weighted based on geotechnical recommendations and specific site conditions/implications. A thorough geotechnical study will be required at each location to determine the site specific requirements and risks.
- This study assignment is based on previous geotechnical recommendation where available. This study does not include a geotechnical review of the costs, new risks, or opportunities. There is a high potential that new construction techniques, technologies, or methodologies may impact the overall project costs.
- No geotechnical information was made available for the Jockvale location. The cost presented assumes that the site conditions will be the same as those encountered at the Greenbank Road grade separation.
- Road structure (granular and asphalt requirements) are assumed based on typical arterial road design. Actual road structure requirements will be site specific to be confirmed by geotechnical analysis.
- Dewatering costs are an assumption based on past projects but may vary substantially depending on construction requirements and should be revisited as part of an EA study.
- Utility costs are a rough estimate based on previous projects of a similar size and scope but will need to be confirmed with the various utilities once detailed design is undertaken.
- OC Transpo operating costs for detour impacts are assumed to be part of the contingency estimate and as such were not broken out further.
- Municipal service replacement requirements to be confirmed by the City's Asset Management Group.
- Property acquisition or easement costs are not included.
- Potential project cost sharing by the City of Ottawa, VIA Rail, Provincial and Federal Governments is not accounted for within the costs presented.
- Rail diversion costs, temporary at-grade crossing infrastructure, and reinstatement are typically based on the Greenbank Road grade separation costs. If temporary at-grade crossings are required at Woodroffe and Fallowfield for the underpass option, this would be more complex and additional costs should be budgeted.
- Calculations for earth excavation do not include allowance for impacted soil handling costs. Contaminated materials need to be confirmed in future EA studies.
- For the Woodroffe Avenue wildlife crossing the actual costs will depend on the size specified during design for the crossing. The estimate assumes a minimum 3000mm x 2400mm Precast Box Culvert might be used.
- For Jockvale Road the estimate is based on maintaining two lanes only with no median.
- It is assumed general costs such as traffic management, 1% public art, and the 2% Contract Initiation is included within the estimate for "Miscellaneous Soft Costs + City" item.
- A lump sum estimate of $100,000 is being assumed for utility adjustments for gas, cable, and telecoms.
- Retaining wall assumes use of reinforced concrete.
- Costs are assumed based on 2017 dollars and should be reassessed in future years when construction is to be conducted.
- Costs for conducting new Environmental Assessments are not included in this cost exercise.

- Major multi-use pathway costs were only considered for the Jockvale grade separation location. Other grade separation locations have only included a minor cost for various small connections or revisions.
- An additional cost was included for relocation and protection of the CN and All Stream fiber optic cable running along the length of the tracks that are to be diverted. The cost was based on experienced costs for Greenbank Road grade separation.

5.1.1 MERIVALE GRADE SEPARATION

Cost estimates for Merivale Road grade separation assume a divided 4-lane urban cross-section approximately 500m in length. The underpass assumes that the road passes under a railway bridge which requires a temporary rail diversion to construct. No pathway cost has been included at this location although there is a desire to include a pathway connection to Black Rapids Creek. Costs include alterations to the parking lot of the St. Monica School. A storm water pond may be required along with a pumping station to handle ground and storm water.

This cost estimate does not include any pricing for the provision of temporary water services or installation of permanent piped water due to impacts to well water. This cost could be very significant and should be considered if it is determined that there will be well water impacts.

Preferred Option Estimated Cost: $75M (see Appendix E for a high level Class D breakdown).

5.1.2 WOODROFFE & TRANSITWAY GRADE SEPARATION

The grade separations for Woodroffe Avenue and the Transitway crossings were considered together as they would likely be completed as a single project. Due to soil conditions and hydrogeological conditions both locations were deemed to require an overpass (road over the existing rail elevation). The proposed Woodroffe cross section was assumed to match the existing 4-lane rural divided road cross-section. The Transitway cross-section was assumed to be a two lane segregated rural road cross section with ditches. Although there is a pathway along the East side of Woodroffe no costing was added for additional pathway connections (for example to the VIA Rail Station) other than making a clearance allowance in the bridge span for a potential future pathway to cross underneath. It should be noted that no consideration was given in this costing exercise related to the potential future City of Ottawa "Woodroffe Watermain Replacement" project that the City has planned. Watermain relocation costs are based on current conditions.

Preferred Option Estimated Cost: $145M (see Appendix E for a high level Class D breakdown).

5.1.3 FALLOWFIELD GRADE SEPARTION

The proposed Fallowfield Road realignment cross-section, was assumed to match the existing 4-lane urban divided road cross-section. The grade separation location for Fallowfield Avenue has the same poor soil conditions and hydrogeological conditions as the Woodroffe crossing and as such was deemed to require an overpass (road over the existing rail elevation). The new bridge would be a multi span structure to go over both the Transitway and VIA tracks. The Transitway was assumed to require no significant reconstruction. Although there are pathways along the South side of Fallowfield no costing was done for additional pathway connections (for example to the VIA Rail Station) other than making an allowance in the bridge span clearance for a potential future pathway to cross underneath. It was assumed that the existing road would be rehabilitated into green space which is reflected in the topsoil and sod quantities.

Preferred Option Estimated Cost: $130M (see Appendix E for a high level Class D breakdown).

5.1.4 JOCKVALE GRADE SEPARATION

The proposed Jockvale Road grade separation assumes a 2-lane undivided urban section with road under rail underpass option. Multi use pathways were considered for this estimate due to the substantial amount of pathways in the area (both current and planned). As part of this consideration for pathway connections a separate pedestrian bridge structure crossing in parallel with a rail bridge was added to make a direct connection between the planned cross town bikeway paths. Costs included for the North detour also account for a temporary relocation of the Barrhaven United Church parking space. A temporary access was also considered as part of the temporary detour costs for the Barrhaven Fellowship Christian Reform Church.

Preferred Option Estimated Cost: $80M (see Appendix E for a high level Class D breakdown).

6.0 ORDER OF PRIORITY REVIEW AND INTERIM MEASURE IMPLEMENTATION

It should be noted that a first order of priority for any of the grade separation locations will likely require that new environmental assessments (or amendments) be undertaken as the existing EA documents are outdated.

The order of priority for the grade separations is derived from the crossing exposure results noted in Section 3.6. Based on the results illustrated in Table 20 of Section 3.6 a grade separation should be considered for Woodroffe Avenue and Transitway as cross product calculations show this location to be well past the recommended exposure limits. Fallowfield is also substantially over the exposure limits and should be grade separated. The Merivale Road crossing is at the recommended exposure limit and will substantially exceed the recommended exposure values by 2031 and therefore should be grade separated. The Jockvale Road project will also approach the recommended exposure limit by the 2031 time frame and should also be considered for grade separation. While the Woodroffe and Transitway grade separation is currently shown as having the highest priority based only on CEI, it should be noted that from past human behavior and due to the complexity of the crossing angle with at-grade crossing warning system (flashing lights and gates) directly adjacent to and interconnected with the Transitway traffic signals for the Transitway parallel to the track, Fallowfield Road would also have a high priority for grade separation. It is therefore recommended that Woodroffe/Transitway and Fallowfield be ideally completed as one project, subject to funding availability, or as close together as possible.

In summary, the order of implementation for each location is recommended as follows:

1. Woodroffe and Transitway Grade Separation.
2. Fallowfield Grade Separation.
3. Merivale Grade Separation.
4. Jockvale Grade Separation.

The implementation of these grade separations assumes that EA studies, design, funding allocations, and property acquisitions that may be necessary have been completed before construction can take place.

6.1 INTERIM MEASURE IMPLEMENTATION

In the interim several measures should be explored further by the City of Ottawa as noted in the previous chapter. These items are copied again below:

6.1.1 MERIVALE INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Merivale Road at-grade crossing location are listed below.

- As a result of implementing grade separation the pedestrian and cycling facilities will also be impacted. The City should explore ways to improve the Merivale Road pedestrian sidewalks (both sides) and cycling facilities between Slack Road to MacFarlane Drive. Consideration should be given to install separate facilities and warning system on the east side of the crossing and/or improvements to the existing west side system to allow for dedicated pedestrian/cycling movements. A multi-use pathway connection would be a viable option. The eventual design for the grade separated facilities will need to incorporate active transportation facilities as well.
- Due to the narrow corridor space, it will be necessary to review and ensure that the works maintain at-grade crossing sight lines as per the regulation.
- Careful site plan control and/or restrictions to adjacent development that may infringe on the required land and driveway access needs for a grade separation solution. It is noted that recent redevelopment of lands to the north and east of the crossing (Suds Car Wash, Enterprise Rent a Car agency, etc.) have created additional access and detour road constraints.
- Consideration should be given to shift the MacFarlane/Merivale intersection further south to the ultimate configuration. It is understood that this intersection was reconstructed and moved as far south as possible within the current City owned property limits. This measure helped improve the available storage requirements for southbound left turning vehicles. However, the storage length is still considered to be deficient and vehicles have been observed to back up across the railway tracks on occasion. Relocation to the ultimate southerly location will provide better storage capacity, lower the risk of vehicles stopping on the tracks, and remove the need for a fifth (5th) lane at the road/rail crossing. This measure will require the acquisition of two properties as identified in the previously completed EA.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.

6.1.2 WOODROFFE/TRANSITWAY INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Woodroffe Avenue and Southwest Transitway at-grade crossing locations are listed below.

- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.
- Prior to the City taking any steps to move forward on construction of any rail grade separation crossing option on NCC and/or other federal lands, the NCC will require the City to engage an experienced and qualified environmental consultant to conduct a federal level environmental effects analysis that incorporates the environmental effects indicated within the Canadian Environmental Assessment Act (CEAA) in order for the

NCC and any other federal authorities (VIA Rail, Fisheries and Oceans Canada, Environment and Climate Change Canada, etc.) to assess potential impacts and proposed mitigation measures, construction monitoring and follow-up studies.

6.1.3 FALLOWFIELD INTERIM MEASURES

Interim safety, site improvement measures and additional studies that should be considered at the Fallowfield Road at-grade crossing location are listed below.

- Careful site plan control and/or restrictions to adjacent development that may infringe on the required property and access needs for a grade separation solution.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.
- An amendment to the Municipal Class EA is required to review the preferred options in further detail, to assess potential impacts and proposed mitigation measures, to refine property requirements and projected project costs, and to present potential revisions to the public and key stakeholders.
- Prior to the City taking any steps to move forward on construction of any rail grade separation crossing option on NCC and/or other federal lands, the NCC will require the City to engage an experienced and qualified environmental consultant to conduct a Federal level environmental effects analysis that incorporates the environmental effects indicated within the Canadian Environmental Assessment Act (CEAA) in order for the NCC and any other federal authorities (VIA Rail, Fisheries and Oceans Canada, Environment and Climate Change Canada, etc.) to assess potential impacts and proposed mitigation measures, construction monitoring and follow-up studies.

6.1.4 JOCKVALE INTERIM MEASURES

Interim safety and site improvement measures that should be considered at the Jockvale at-grade crossing location are listed below.

- Careful site plan control and/or restrictions to adjacent development that may infringe on the required property and access needs for a grade separation solution.
- Conduct a site specific Municipal Class EA.
- A site specific geotechnical investigation should be implemented to update surface and subsurface condition recommendations, construction recommendations, potential risks, and cost implications.

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